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U. S IMPROVEMENTS OF THE COLUMBIA RIVER, OREGON AND WASHINGTON.

By W. P. HARDESTY,* C. E.

The Columbia River is the second river in size, measured by volume, in the United States, its maximum flow of 1,600,000 sec.-ft. being only slightly exceeded by that of the Mississippi.

The river drains most of Oregon, Washington and Idaho, portions of Montana and British Columbia, and even parts of Nevada, Utah and Wyoming.

The Columbia is much the largest of the rivers emptying into the Pacific Ocean, and it is the only one (excepting possibly the Colorado) that cuts through high ranges of mountains on its way to the sea. The river forms a natural channel of commerce between the interior country and the ocean, and at its mouth affords the only deep water port in the 700 miles of coast between San Francisco Bay and Puget Sound. It is naturally navigable for all craft of moderate draft from the ocean to the mouth of Snake River, a distance of 328 miles, except for the obstruction formed by some large falls and rapids.

The lower Columbia, since its first discovery, has been navigated by ocean-going vessels as a means of reaching interior points. Of these, Portland, Ore., is the principal port for ocean and river traffic, although located about ten miles from the main stream, on the Willamette River, and distant about 110 miles from the ocean.

The Columbia has excessive widths for most of the distance below the Willamette, allowing the formation, in places, of numerous sand bars and shoals, through which the naturally navigable channel pursues a tortuous course. The depth over these varied from 10 to 15 ft. at low-water stages in the unimproved condition of the river.

To deepen and straighten the channel, dredging operations have been carried on for over thirty years past, and a definite project has been formulated by the U. S. Engineer Department for securing a low-water channel depth of 25 ft. all the way to the sea. This will be done by building cross dikes and training dikes to contract the channel in wide places, and by dredging. There has been comparatively little trouble in maintaining a depth of 22 to 25 ft., of late years, over the worst of the bars, with only a few months dredging each year. For 75% of the total distance the depths range from 30 to 50 ft.

This article will describe the jetty out at the mouth of the river, which has been under construction for many years, and also the Celilo-Dalles Canal, around rapids in the river.

IMPROVEMENT OF THE MOUTH OF THE COLUMBIA RIVER.

The estuary of the Columbia begins about 30 miles from the ocean. It attains a maximum width of about 12 miles, and then contracts at the mouth. The mouth of the river is formed by two projecting points (see Fig. 1). On the north or Washington side is the headland called Cape Disappointment. On the south or Oregon side is Point Adams, merely a low sandy ridge. Projecting still farther northwesterly from the latter is Clatsop Spit, a sandy beach that is partly flooded at high tide.

Navigation for vessels of large draft has been hindered by the large bar lying just outside the mouth of the river, formed partly of sand brought down by the river during the flood season, but probably mostly due to the ocean itself. In its natural state this bar is constantly shifting, due to the action of waves during storms. To secure and maintain a sufficient depth of water over the bar, the U. S. Engineer Corps, in 1884, inaugurated work on a jetty project.

Just within the mouth of the Columbia there is comparatively little trouble in securing ample depth of channel. It is just outside the mouth where the most radical remedy is required. The object sought is the scouring out of a channel through the bar by contracting the waterway so that the ebb tide will carry out the material. This is being effected by means of a jetty.

FORT STEVENS JETTY.—The jetty improvement consists of a single jetty having its root at the U. S. Army post of Fort Stevens, on the easterly side of Point Adams and well within the mouth of the Columbia. As projected in 1884, this was to extend in a direction west by northwest for about 4½ miles, running across Clatsop Spit to a point in the ocean about three miles south of Cape Disappointment. The jetty was to be built of rubble stone of large size, laid on a bed of brush mattresses and raised to the level of low tide. In 1893, before completion, the project was modified so as to provide for raising the jetty to high tide, and also for building four groins, from 500 to 1,000 ft. in length, on the north side of the jetty.

CELILO FALLS ON THE COLUMBIA RIVER, FROM THE OREGON SHORE.

The projected jetty was estimated to cost $3,710,000, and it was completed in 1895 at about half that sum, or $1,968,753. In that year a depth of 31 ft. was attained (measured from the mean of the lower low tides) over the bar, an increase of 11 ft. over that existing in 1884.

The improvement made by the jetty did not prove to be permanent, however, as a gradual shoaling set in, and by 1899 the best depths had decreased to 28 ft. The channel had also shifted into an unstable position, two miles north of the 1895 channel. By 1902 the depth had decreased to 21 ft. To secure a permanent and deep channel, it was recommended by the engineers in charge that the jetty be extended a further distance of three miles. In 1902 a board of engineers reported a definite project for strengthening the old jetty and extending it a farther distance of 2½ miles, and for ultimately building a jetty on the north side—from Cape Disappointment—if contraction on that side should be found necessary. The use of a dredge to aid the concentrated current in deepening and maintaining the channel was also proposed. Work under this project was begun in 1903 and is now well toward completion.

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The jetty proper (Fig. 2) consists simply of stone of selected sizes, dumped to form a dike, or enrockment, to turn the current, with mattress foundation under the original part. A very important part of the construction, however, is the pile-trestle tramway (Fig. 3) over which the stones are hauled to the places where needed.

In the trestle work (Fig. 2) each bent consists of two pairs of piles; one pair for each of the tramway tracks, which are spaced 13 ft. The two piles for each track are spaced about 5 ft. apart and they are braced together near the top with two 6 × 6-in. diagonals. A 12 × 14-in. cap is used, extending over the four piles, and a 12 × 16-in. stringer is used under each of the four rails. The tracks are of 3 ft. gage, laid with 40-lb. rails. The bents are spaced 18 ft.

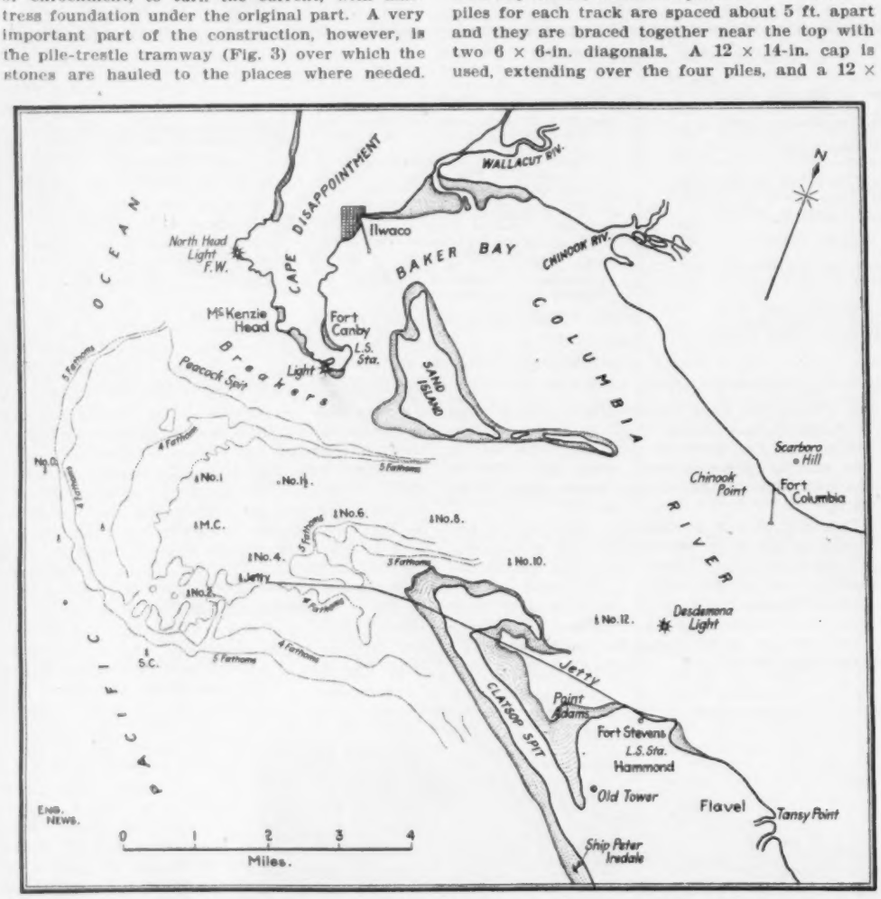

FIG. 1. MAP OF THE ENTRANCE TO THE COLUMBIA RIVER, FROM A SURVEY OF JUNE, 1907; SHOWING LOCATION OF JETTY.

The locality is so much exposed to the storms from the ocean that it is entirely impracticable to deliver the rock from scows or barges. For the same reason the building of the trestle tramway is exceedingly difficult work, and the maintenance of the structure against the shock of the huge waves during storms has proven to be a very expensive part of the project. This applies, of course, to the more exposed part of the jetty, that beyond Clatsop Spit, where it is entirely in the main ocean.

It has been found that the first severe storms after finishing the enrockment generally flatten it out by knocking down the narrower section at the top, the rock so displaced tumbling down the slopes of the jetty, so that it is often razed to a point 7 ft. below low tide. That part of the old jetty that is imbedded in or lies behind Clatsop Spit is protected from the seas and is but little damaged by them, and it is also free from the teredo on account of the presence of fresh water.

A preliminary to the extension of the jetty has been the rebuilding of the old trestle where destroyed, and the repair of the portion more protected from the ocean, inside of the sand spit. Though the plans for the first jetty called for a mattress foundation, it was found to be impracticable to place mattress in deep water in the open sea, so it has not been used at all in the new jetty. In the new work the rock is dumped and allowed to assume its natural slope, usually about 1¼ to 1, and it is brought up to a point about midway between low tide and high tide. At this locality the distance between the mean of the lower low tides (taken as the plane of reference) and the average high tides is 7½ ft., and the extreme variation is about 11 ft. On this coast there are two ebb and two flood tides each 24 hours.

ORGANIZATION AND METHODS OF WORK. —The work on the jetty has always been carried on by the government direct, by day labor. The plant and equipment have grown until now they form one of the best outfits for jetty work to be found in the country. They consist of the docks, derricks, yards, shops, quarters, etc., at Fort Stevens, and their equipment, the double-track tramway and all of its rolling stock, the pile-drivers, material yards, etc.

At the docks are received the stone and other material for constructing the jetty. There are eight derricks, and four more are to be installed, for which the extension of the docks has already been made. The derricks (Fig. 4) are principally used in transferring material from barges or from the water to the cars of the tramway.

In hauling stone, dump cars are used (Figs. 5 and 6) with movable beds or boxes. The derrick chain is attached to a box and it is swung down to the barge where it is loaded, the larger stones being handled by the derrick and the smaller ones loaded by hand. In hoisting a box a chain with four branches, one to a hook at each corner of the box, is used; the box is swung into position over its car, when by a little adjustment by hand it is placed and made secure.

Stones from 20 lbs. up to 15 tons weight are loaded, the largest one ever handled weighing 18 tons (see Fig. 4). The specifications call for three classes of stone: Class A, 6 tons to 15 tons; Class B, 1,000 lbs. to 6 tons; and Class C, 20 to 1,000 lbs. The approximate percentages of each of these required are 20, 55, and 25, respectively. Two-thirds of Class B must range from 2 to 6 tons, and the remainder 1 to 2 tons. A car load of Class C stones averages about 8,500 lbs. In Class A, one stone makes a load. The specifications were drawn in such a way as to get the product of the best quarries available for the work. If the rock formation were of a character to admit of larger and more uniform stone the specifications would have differed as to sizes. The sand rock gives the largest piece.

Each train load of stone is run onto a large scale, where the cars are weighed, two by two, and the classification is also made at the same time. This stone has been delivered under several contracts; the average price of recent work has been $1 to $1.10 per short ton, delivered from barges at the docks. It is sand rock and basaltic rock, and most of it has come from quarries about 100 miles up the Columbia.

The dump car used (Figs. 5 and 6) is termed a "geared dump car." Each car is mounted on two two-wheel trucks. The body of the car is mostly of wood, with some steel used at the ends, especially at the dump-gear end, where a frame is built up of angles and plates to support the gearing. A swing frame is used to support the box, and this is tilted to the desired angle by a segmental rack bar operated through worm gearing. The angle of dump is 33°. The box is of lumber, strongly made. The entire car weighs 10,000 lbs. The car wheels and other castings were cast in Portland, but all the rest of the work was done by the government at its shops. The car was designed by the government engineers. There are 180 of these cars at present in use, and 70 more are under construction.

All construction material is hauled out over the tramway to the front. For all new work the center line of the enrockment is that of the trestle. Framing of the trestle follows as each bent of piles is driven, and the dumping of stone to form the enrockment is now kept close behind, the completion of the enrockment following at about 1,000 ft. back.

Where the old trestle was carried away, as occurred for all that part in the open sea, the rebuilding has been a job quite out of the ordinary.

There are two possible methods of rebuilding the old trestle. One is to build the new one, either along the channel (right) side of the old enrockment, or on the seaward (left) side. There are several objections to this plan. If placed on the channel side the trestle would stand in a strong tidal current, which would cause scour around the feet of the piles, while if placed on the seaward side it would be exposed to the force of the heavy breakers coming in from the southwest. In either case the trestle would be a high one, measured from the sand bottom, and as it would be unsupported by any enrockment it would sway excessively in a running sea.

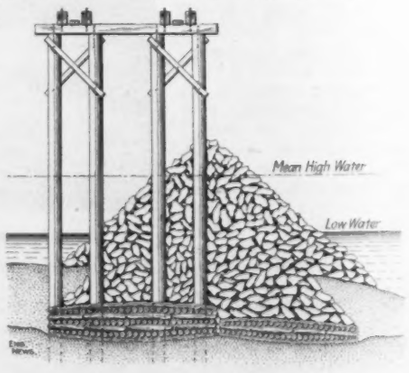

Fig. 2. Section of Columbia River Jetty, Showing Tramway Track also.

The second possible method was to restore the trestle directly on the line of the old enrockment, and this method was adopted.

All of the old enrockment is being greatly enlarged by widening and raising so that the new trestle follows it, in places along its center and in other places along its shoreward slope. This requires the seemingly impossible feat of driving piles into the enrockment itself. This is done by shifting the point of the pile around and find-

ing by trial the crevice, between the largest rocks, into which it can be driven farthest, which may be 3 or 4 ft. from its proper position. This has made the alinement of piles very irregular. To hold the piles in position after first driven, until sufficient rock can be piled around them, temporary 3 × 12-in. bracing is spiked on, generally extending across three piles of a bent. After sufficient rock has been placed

FIG. 3. VIEW OF COLUMBIA RIVER JETTY AND TRAMWAY, LOOKING SHOREWARD.

the temporary braces are taken off and the permanent ones (6 × 6-in.) are put on. The enrockment is raised to about 4 ft. above mid tide in order to give support to such of the piles as may not have much penetration into the rocks.

The two pile-drivers used here are worthy of special note. They are known as "seagoing" pile-drivers, and were designed by the government engineers and built at the plant.* The newer pile-drvier (Fig. 7) (built only two or three years ago) is an improvement on the old one. One feature is in having the feed pipe for the jet pass down through the hollow king pin on which the revolving platform turns. As the driver is really a jet driver, the 5,700-lb. hammer is intended not so much for driving as for a weight to help force the pile down after the jet. In redriving in the old enrockment the hammer alone is used. The new pile-driver cost about $12,000, and its weight is about 60 tons. It has a reach each side of 33 ft., and the height of leads above cut-off of piles is about 80 ft. The leads will not take in a pile over 26 ins. through, but 30-in. piles have been driven, where the jet, only, was used, by letting the hammer rest on the edge of the pile. On this work piles as long as 130 ft. have been driven; some piles have been driven as much as 50 ft. into the bottom, while others have been driven in water 50 ft. deep at low tide.

When at work the pile-driver has a tender attached to it, which runs on the double track (13-ft. centers), as does the driver. On the tender are placed the piles and other material for the trestle. The piles are carried crossways on the tender, which is much handier for the pile-driver than where carried lengthways, as in case of a single-track driver. An ingenious utilization of this feature of the double-track tender is made in soundings taken from the trestle. Two piles are placed close together, on which the engineers can walk out the full length and take cross-sections of the existing enrockment and the bottom adjacent. The sea is seldom smooth enough to permit use of a boat.

The construction of the old jetty soon resulted in the formation of a large sand bar along all but that part beyond Clatsop Spit, greatly strengthening it. It also created an immense bar where Clatsop Spit is crossed, which was formerly covered with water at all stages. This bar, called "The Sands," is used for material yards and switch yards for the work. All of the ground near the root of the old jetty, including that covered by the yards and shops and much adjacent land, has been formed by the jetty, and this reclamation is in addition to its work of restricting the river width. The first 3,000 ft. of jetty is now on made land.

At The Sands, three miles out, are stored large quantities of the treated piles and the sawed timber for the trestle building, which is a great advantage during active construction in that it prevents delay that would be occasioned if the material had to be brought all the way from the main plant. The pile-driver is also kept here, ready to be quickly run to the front on the days that pile driving is required.

For safety during fogs, in operating trains on the tramway, a species of block signals is in use. The line is divided into six blocks. In addition to semaphores the telephone is used as an aid. The telephone line runs out on the trestle to near the front, where a movable station is kept at the last cross-over between the double tracks, where a switchman attends to both duties.

DIFFICULTIES OF CONSTRUCTION AND MAINTENANCE.—A very grave problem in connection with maintenance of the trestle has been to prevent action by the teredo, whose ravages are such that often piling only a year or two in place is so honeycombed with boring that it has very little strength (see Fig. 8). Creosoting has been suggested, but it is considered hardly practicable here, particularly as it greatly reduces the strength of the wood. A preventative has been in use the last two or three years, consisting of wrapping each pile over the portion likely to be in the water (approximately the middle third) with three thicknesses of burlap, saturated with the best Welsh coal tar, coats of tar also being used between the layers. The burlap is fastened on with staples.

As at first used, this method was open to the serious objection that the dumping of stone from the trestle knocked off this protection in places, leaving openings for the entry of the teredo. To prevent this, a number of longitudinal pieces of 2 × 4-in timber are nailed on, placed at intervals around the circumference. This expedient has been adopted within the past year. The wrapping is put on at the yards at Fort Stevens. The method of protection is considered experimental as yet, but with very good prospects of success. Mere coating of the piles without use of the burlap would not do here, as it would be worn off by the continuous action of the waves.

After completion of the jetty, in 1895, the portion of the trestle exposed to the sea was soon destroyed. When work was begun on the new project, in 1903, the first requirement was the rebuilding or repairing of nearly all of the trestle and its tramway, after which the old enrockment had to be greatly raised and strengthened.

The old jetty began at the U. S. Engineer Department wharves or docks and ran through comparatively shallow water until well beyond Clatsop Spit, the depth at low tide running from 0 to 22 ft., and averaging 10 to 15 ft. In the last 1,000 ft. the bottom pitched off to a depth of about 37 ft. The end was 4.7 miles from the root. The mattress foundation was discontinued at a depth of about 22 ft. The four groins, each 600 to 1,000 ft. long, proved very effective in preventing scour and in causing accumulation of sand along the jetty.

The grade of the tramway above low tide increased from about 19 ft. at a half mile out to 26 ft. at 1½ miles out, and thence to 32 ft. at the outer end, which height is maintained by the new trestle extension.

The new jetty is a 2½-mile extension of the old one, and the total length will be 7.2 miles. The extension runs almost due west from the end of the old one, and it will end at the main bar, at a point about 2½ miles west and three miles south of the point of Cape Disappointment, and over three miles beyond the sands of Clatsop Spit.

The deepest water on the line occurs near the junction with the old jetty, caused by the scour of the current around the end of the latter during the years before the new one was started, and it reaches a maximum of 50 ft. Beyond there it ranges from 30 to 42 ft. to the present terminus, 1¼ miles from the proposed end.

A profile of the entire jetty, taken in September, 1906, shows an enrockment varying in height above low tide from about 15 ft. near the inshore end to about 5 ft. near the end of the old jetty, beyond which the new work is being gradually raised above low tide. For the first ¾-mile of the new jetty a marked scour on the north or channel side has occurred, varying from about 15 ft. near the start, to nothing at the end of this portion, beyond which a light fill has occurred. On the south side of the jetty there has been a filling in, mostly from 5 to 15 ft., but amounting to 30 ft. at the end of the old jetty. It has been proposed, if the scour should become too bad, to build several groins on the channel side, as was done for the old jetty. The conditions of scouring and filling have greatly varied at different periods, as less than a year before the date above noted both sides of the jetty showed much scouring, and it was even suggested that groins would be needed on both sides.

The annual survey of the bar, made in June, 1907, showed a shoaling on both sides of the trestle, which will be a necessary condition for permanency of the enrockment. It also showed that the scour set up by the incomplete jetty had steadily continued, and that there were four distinct depressions, each about 25 ft. deep at the

Fig. 4. Derrick Lifting an 18-Ton Stone from Boat Onto Dump Car, Columbia River Jetty.

shoalest point at lower low tide. It is probable that these channels, covering an area about ¾-mile wide, will soon be merged into one broad one, which will then be used by navigation. The depth desired on completion of the project is not less than 30 ft.

As a partial substitute for mattresses, for all

*See Eng. News of April 18, 1891, for description of the first pile driver, written by U. S. Asst. Engineer, G. B. Hegardt. This description is included in an article on "The Columbia River Jetty."

entirely new enrockment there will be used the method of placing only small rock (all Class C) on the bottom, as this turns the current more completely than the larger rock with its many great crevices. This stone will be a separate lot from that used in the main part of the enrockment, where the proportions before noted will be used. Up to June 30, 1907, a total of 1,146,224 tons of stone had been used on the new project.

At the beginning of the fiscal year 1903–4 the renewal work was completed to the end, about 25,000 ft. from the root. This was on the seaward side of Clatsop Spit, just where the deeper water begins. A few hundred feet of new trestle was then built, but during the following winter nearly 1,000 ft. of the old trestle back of it was destroyed. After restoring this, the extension of the trestle was resumed, and during the summer season of 1904 it was carried to a distance of 7,576 ft. beyond the end of the 1895 jetty. This trestle was strengthened near the outer end by batter piles on one side and by guys secured to anchor piles on the other. During the storms of the following autumn and winter a large portion of the trestle rebuilt in 1903, considerably over 1,000 ft. of the old trestle and some of the 1904 trestle, were carried out, so breaking it up that the building of entire new trestle and tramway, beginning at the sands of Clatsop Spit, as before, was necessary during the season of 1905. During that season the trestle was built out for a distance of two miles, reaching to a point six miles from the root. This was the season's work for one pile-driver, it being found that the maximum rate of pile work per working day was 100 lin. ft. For about two-thirds of this length the piles were treated with the tar and burlap covering (without use of the 2 × 4-in. protective strips), but to avoid delay the last 3,400 ft. was built with untreated piles.

Since 1905 no further extension of the jetty has been made, but efforts have been concentrated on finishing the enrockment along the trestle already built. As the trestle is so short-lived, it is considered unwise to extend it any faster than the complete enrockment can be built along it, as the latter also helps to protect it. For the same reason it has been strongly recommended that, in the matter of appropriations, authorization be given to put the work on a continuing-contract basis, so that it would not have to be shut down to wait for further appropriations. This would result in large parts of the work having to be done over again, as the trestle is quickly destroyed.

During the fiscal year ending June 30, 1907, about four miles of old trestle was rebuilt or repaired. Of this, about 2,100 ft. was in the open sea beyond Clatsop Spit, while 19,000 ft. was across the spit and inside of it, where the enrockment was completed. The renewal of the latter section was made because the trestle had dry rotted so that it was no longer safe for heavy train loads of stone. Where entirely new this portion was built to one side of the old enrockment. The work gave practically a new double track from the shore to the present terminus.

Over one mile of trestle was carried out during the winter and spring of 1907, when the storms were of almost unprecedented fury, so that when the season's work was resumed the end of the trestle was over a mile in from the end of the enrockment. On none of this portion had the enrockment been raised above low tide. Though on all of this portion the piling had been greatly weakened by the boring of the teredo, it is believed that if the enrockment had been of sufficient height the trestle would have stood. Experience at neighboring, though more protected, points on the coast indicates that when the enrockment is brought up nearly to full tide that the support afforded will keep up the trestle, notwithstanding the teredo, which works but very little above low tide.

As a result of all these experiences, a more radical enlargement of the enrockment cross-section was adopted at the beginning of the 1907 season, and all of the enrockment in the open sea is now brought to the full width of the trestle at mid tide instead of to only 8 ft. as in the original plan.

The greatest obstacle to the completion of the work has been the difficulty of maintaining the trestle against the tremendous onslaught of the heavy seas that occur, more especially during the winter and spring months. Time and again whole sections of trestle containing from three to a dozen bents have been carried away, and in April, 1907, one storm took out about a half mile of trestle at the outer end, leaving a short stretch behind it and then destroying another large section closer in. The pile construction has been of the strongest, but the ravages of the teredo have so quickly weakened the piles that they soon gave away. Work is usually suspended between January and the spring, when the storms are the worst. It is also suspended during very windy days, as it is then both difficult and dangerous to work on the trestle. With a wind velocity of 60 miles an hour is coupled the condition that portions of the trestle are completely enveloped in spray from the waves. It is probable that there is no other engineering work in the United States under way at the present time at all equal to this one in its difficulties, uncertainties and dangers. Building a jetty or breakwater out into the open sea, which is here exposed to all the coast storms, is quite a different matter from building one in a sheltered harbor.

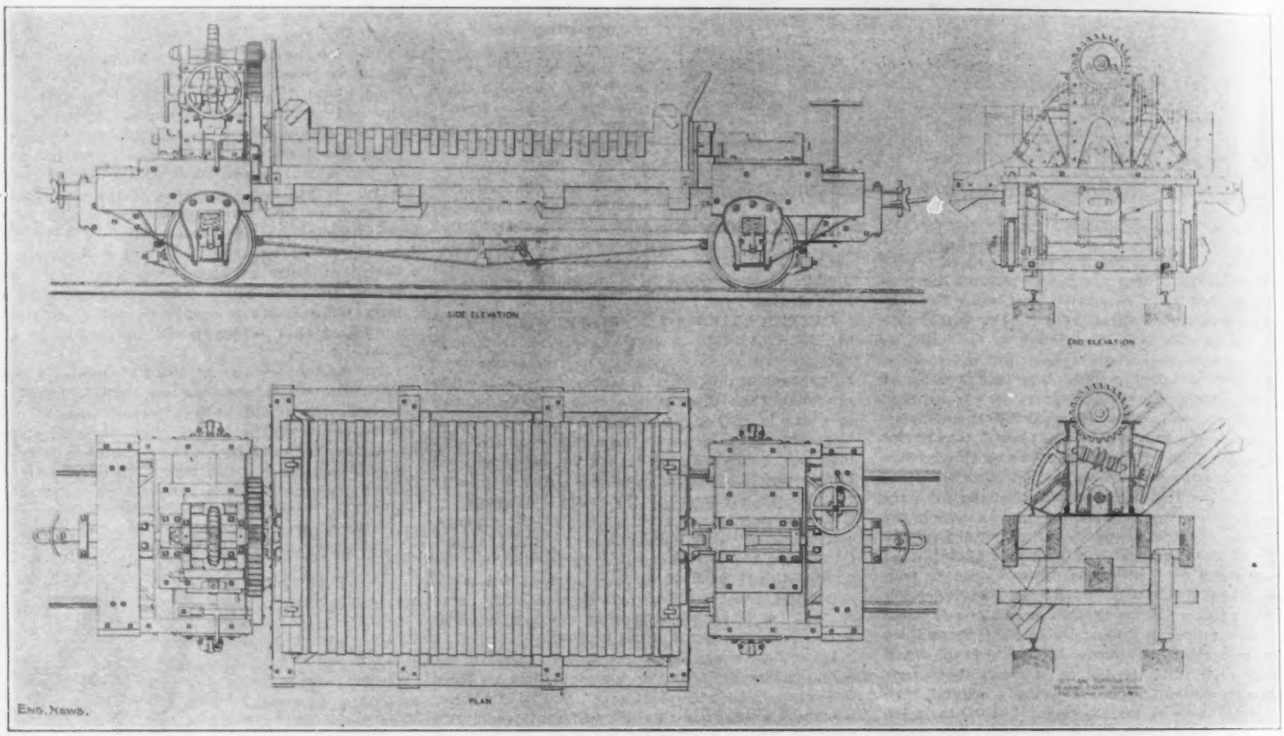

FIG. 5. SELF-RIGHTING GEARED DUMP CAR, COLUMBIA RIVER JETTY CONSTRUCTION.

As before stated, all of the jetty work has been done with the government's own force and plant. The ten locomotives and the dump cars are kept in repair at the shops. At the latter is done all the repairing for this project, and in addition a large amount of work for the fortifications at Fort Stevens. Considerable work is done for other U. S. Engineer works in the same district, and dump cars are now being built for the Grays Harbor, Wash., improvements. A small amount of work is also done for the Light House Department, the latter being a division of the Department of Commerce and Labor.

At the end of the season of 1907 there was still 1¼ miles of the projected extension on which no work had been done, as all work was concentrated on strengthening the old jetty. The total expenditure to June 30, 1907, was $2,894,740. It was estimated that two, and possibly three, years would be required for finishing the project. There had been appropriated (for the 1903 project) the sum of $3,350,244, and $1,700,000 in addition had been authorized for continuing contract. The latter was the estimated amount necessary for finishing the work. As the board's estimate for the south jetty part of the full project was only $2,260,000, the grand total of $5,050,244 is $2,790,244 in excess of the estimate

of the board of engineers. That the estimate of the latter should be greatly exceeded is not remarkable, in view of the constantly increasing difficulties of the work, and also the abnormally high price of labor and materials during the past two or three years. Few engineering works have been so difficult to estimate, on account of the uncertainties and the destructive forces found to contend with, and it is possible that still others are yet to appear. It is considered improbable by the engineer officials that the $5,050,244 total will finish the jetty.

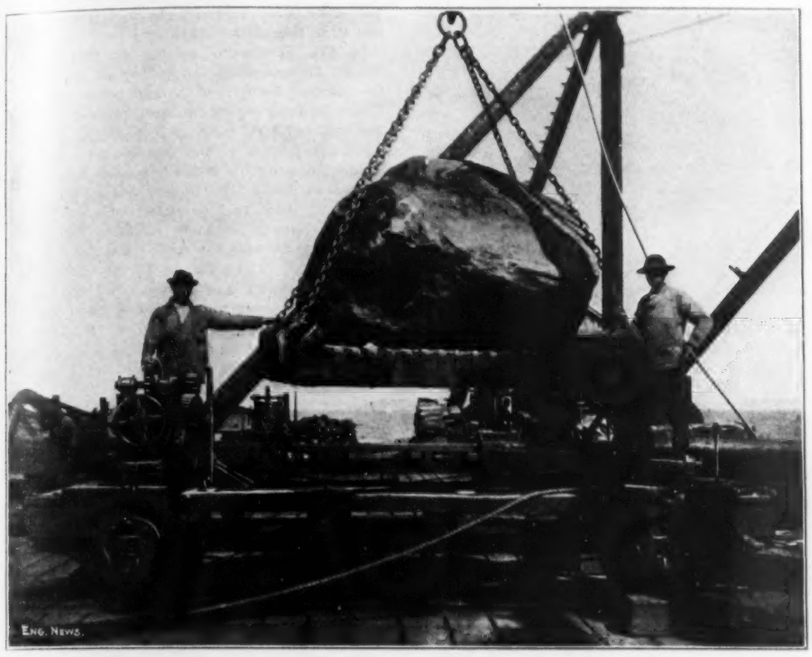

FIG. 6. LOWERING STONE ONTO DUMP CAR, COLUMBIA RIVER JETTY.

PERSONNEL.—All of the jetty work has, of course, been in charge of the Engineer Corps of the U. S. Army. Several different officers have at different times been in charge of the district, which includes improvement of the Columbia and all of its tributaries. Of the civilian assistants, Mr. G. B. Hegardt was Assistant Engineer in direct charge of the work at the mouth of the river from 1890 to 1904. Mr. Gerald Bagnall, Assistant Engineer, has been in immediate charge of this work since 1904, and he is assisted by Mr. G. F. Whittemore, Junior Engineer. Lieut. Col. S. W. Roessler, Corps of Engineers, has been district officer since Aug. 15, 1905. To the gentlemen named the writer is indebted for information from which this description has been prepared.

CANAL AND LOCKS BETWEEN THE DALLES AND CELILO FALLS.

The work just described is needed to fit the Columbia for passage of ocean-going vessels up the river to Portland. Above the mouth of the Willamette only river boats need a channel. Except for some bars shortly above the Willamette, no dredging is needed, as the character of the obstructions is entirely different, being composed of rocky reefs in the bed and including several series of rapids and falls. Of these, the Cascade rapids, about 50 miles above Willamette, have already been improved with locks—opened in 1896.

About 45 miles above the Cascade Locks on the Columbia begins another series of rapids in the river. This extends from a point about two miles above the city of The Dalles to the town of Celilo, at the head of Celilo Falls, both in Oregon.

The Dalles is the present head of navigation on the lower Columbia. It is located immediately above the head of the Columbia River Gorge, at a distance of 196 miles from the sea. In the river above here there is first the Three Mile Rapids, two miles above The Dalles, where for 1,500 ft. the stream is naturally confined in a narrow and crooked channel, much obstructed by submerged rocky reefs. Two miles further up begins Five Mile Rapids (The Dalles proper), where for 1½ miles the river is confined in a chasm of 150 to 300 ft. width, formed by precipitous rock walls, and in which it rushes with great velocity. Nearly four miles above these begins Ten Mile Rapids, a similar gorge but only ½-mile in length. Lastly, there are Celilo Falls, where the river pours over a break in its rocky bed with a vertical drop that amounts to 20 ft. at low water, the total fall in the main channel in a distance of about 1,200 ft. being nearly 40 ft. The total distance from the city of The Dalles to the upper side of Celilo Falls is 12 miles. The total fall in the river surface is about 82 ft. during low water and about 60 ft. during ordinary high stages.

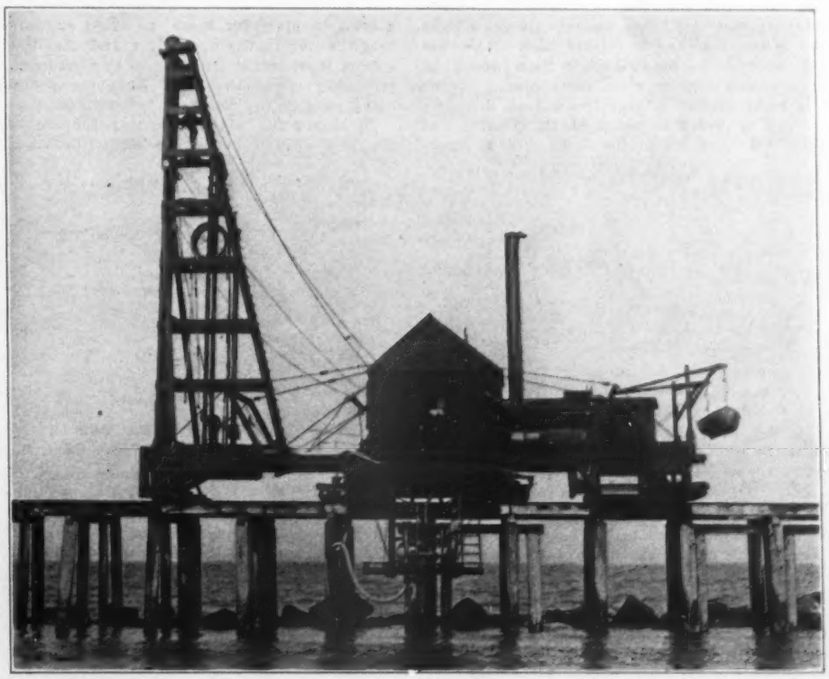

FIG. 7. PILE-DRIVER USED ON TRESTLE, COLUMBIA RIVER JETTY.

The features described make it impossible for boats to ascend the Columbia any further than this locality. With these obstacles removed, navigation would be open from the ocean to the mouth of the Snake River, and thence for 145 miles up the latter to Asotin, 473 miles from the sea and just above Lewiston, Ida.

Boats can also go up the Columbia to Priest Rapids, 73 miles above the Snake River.

As early as 1882 the improvement of this portion of the river was recommended in a project submitted by the U. S. Engineer Corps. There have been a number of different projects proposed at different times, and the first adopted, by act of Congress of August, 1894, was for a boat railway capable of transporting boats of 600 tons. By this act $100,000 was appropriated for beginning work. Other appropriations and modifications of the original project have followed the first move, and on May 8, 1905, a definite project for beginning construction was approved by the Chief of Engineers.

The final project is as follows: The building of a continuous canal (Figs. 9 and 10) located on the Oregon side of the river, and reaching from Big Eddy, at the foot of Five Mile Rapids, to the head of Celilo Falls, a length of 8.4 miles. This canal is to contain five locks. There is also included river improvement of Three Mile Rapids, now completed; as a matter of fact the whole of the canal work itself comes under appropriations for "Improvement of Three Mile Rapids."

The valley traversed by the river has the broken lava rock formation characteristic of this section. The solid rock bed and banks are broken by wide fissures at many places, and in the bed are many projecting points and some small islands. At each side of the main channel, more particularly the south side, is a low bench of solid rock which is overflowed at high water.

The canal has been located on the south side of the river channel, varying in distance from less than 100 ft. to nearly ½ mile. The plans call for a bottom width of 65 ft. and a depth of 8 ft. in the canal, and for locks of 300 ft. between hollow quoins and having a clear width of 45 ft. In design of the canal and locks there had to be considered the extreme vari-

ation between high and low stages of the river, which ranges from 32 ft. above the falls to 90 ft. below them and is 59.6 ft. at The Dalles. The ratio between the rise or fall below the falls and above them is usually about 2½ or 3 to 1, it being 4 to 1 immediately below the Celilo Falls at low water.

During extremely high water the surface drop over the falls becomes practically eliminated, and there is then an average fall of about 5 ft. per mile extending from the upper side of the falls to below the Three Mile Rapids, the greater part of the drop occurring in the Five Mile Rapids. From the latter the fall during low water to the ocean is about 45 ft. During these highest stages steamboats have been known to run over the falls to the lower river in safety. The record high water occurred in June 1894, when the stage in the lower river was about 25 ft. higher than the ordinary annual high water.

The main line of the Oregon Railroad & Navigation Co. runs close to the foot of the hills on the south side, and immediately below it is the State Portage Railway, a road owned and operated by the State of Oregon. The location of the canal is affected by the former line, as it has to keep between it and the river. In general, the location is as far back from the main river channel as is economically allowable, both to shorten the line and to avoid the many breaks in the lava formation that are traversed by subsidary channels during high water. All the government works are on a right-of-way purchased and presented by the State of Oregon, which was a preliminary demanded by the United States.

The conditions to be met in design of the canal and locks are quite exacting. The ordinary change between high and low water of each year varies from about 16 ft. above the Celilo Falls (see view on front page of this issue) to 45 ft. immediately below them, and to 70 ft. at the head of the Five Mile Rapids. For nearly one-half of its length the canal floor is to rest on a natural gravel formation, quite pervious to water. In order to prevent the upward pressure against the floor when the river level would be higher than that in the canal immediately adjoining, it is necessary, by means of connecting inlets, to allow the water in the canal to stand even with that in the river. To prevent "drowning out" and consequent disuse of the canal before reaching a certain high stage, the walls have to be much higher than would be the case with slighter river variations.

The total amount of lockage during the lowest stage of water is about 81 ft. During the highest stage at which the locks will be operated it is about 30 ft. less. The total amount of surface fall during the flood of 1894 was only 45 ft.

In planning the canal and locks, the floor level at the head was fixed at 81 ft. elevation (the datum plane being 36.7 ft. above mean sea level), and it was made practically continuous for a distance of 6.8 miles, with a fall of only 1 ft. For lockage on this stretch there were two alternate plans proposed. In each there was one lock near the head. In the first plan there would be no other lock; in the second one there would be an intermediate one at 3¼ miles from the head. The first plan has the advantage of eliminating the extra lock. The second one obviates maintaining the walls below the lock to the same height as those above, the difference being about 5 ft. The second plan has been adopted.

The plan calls for a guard gate near the head, below which is a boat basin, followed by the first lock, the intermediate lock, a third lock opposite Five Mile Rapids, and two locks in tandem for delivering boats to the river at Big Eddy.

Fig. 8. Effect of Teredo on Pile in Columbia River Jetty Work; After About One Year's Exposure.

At the diversion from the river the canal has converging sides, leading to a straight section 45 ft. wide on the bottom, the walls of which batter 1 in 24. This is in a solid rock cut, near the lower end of which is placed the guard gate. About 80 ft. below the guard gate the section expands into the boat basin by a divergence of the land wall (left side of canal), reaching its full width of 150 ft. in a distance of about 230 ft. This width continues for about 260 ft., when the land wall again draws in; the width reduces to 96 ft. in about 150 ft., then to 76 ft., and finally to 45 ft., just before reaching the upper gate of first lock, a distance of about 1,600 ft. from the guard gate.

BOAT BASIN.—The boat basin is intended for a lying-in place for boats, to avoid exposure to rough water in the open river and also the objection there might be by some to anchorage immediately above the falls. Snubbing posts are being built in the walls for tying up to.

To obtain the width necessary for the basin, the river wall (right side) is located across much lower ground than otherwise necessary, requiring filling in of most of the right side of the bottom to bring it up to grade. Loose rock is used for this filling, with a mixture of sand and gravel to fill up the voids. On the land side of the location was a nearly vertical rock bluff, so that it was impracticable to have much of the basin in excavation.

In inviting bids on the work there were two alternate types of wall proposed. One called for reinforced concrete for about 1,150 ft. of the river wall and 450 ft. of the land wall, a light section with buttresses every 10 ft. being used. The other was for a gravity section of plain concrete. The latter plan was adopted, as the bid was the lower.

Fig. 11 shows the details of the design of the boat basin. Fig. 12 is a view showing the forms for the blocks of the top section of the river wall. Fig. 13 is a general view of the basin as it appeared during construction, the foundation for the river wall having been merely completed at the time the view was taken.

In the maximum section of river wall the height from foundation to top of wall is 52 ft., the portion below the ground being the visible. There is first placed a continuous base block of concrete, 17.5 ft. wide by 3 ft. thick. On this are built the hollow sections or blocks, each 12.5 ft. long. Each hollow block has sides 3 ft. thick and ends 2 ft. thick; the former are set in 12 ins. on the base block and are also recessed 6 ins. into it. The hollow inside is therefore 9.6 × 15.6 ft. The block is brought up to within 3 ft. of the floor grade, a height of 16 ft. The hollow is filled with sand and gravel, well compacted by water while being placed and by the flooding that naturally occurs from rises in the river. The filling is stopped 18 ins. short of the top, to allow a secure bonding with the solid top block.

The top block rests directly on the other and its interior filling, and it has the same exterior dimensions, 15.5 × 19.6 ft. It is continued up vertically for 18 ins., where the batter of each side begins. The outer side (next the river) has a compound slope, a re-entrant angle being placed at 10.5 ft. up, the batter on the upper part, which is all that is exposed, being 1 to 8. The batter of the inner side is 1 to 5. The top of the wall is at elevation 111, being 30 ft. above the floor of the basin. The top width is 3 ft. A good bond is made at the junction of the adjacent top blocks, and also of the hollow blocks, by making two or three vertical V-shaped grooves in the blocks first built.

The river side of this wall is banked up to elevation 96 with loose rock, sand and gravel, the top 2 ft. being a pavement or hand-placed riprap. This filling runs out horizontally for 32 ft. and then slopes down towards the river 3 on 1.

The river wall ranges from 1 to 52 ft. in height, about two-fifths of its total length of 1,600 ft. being founded on solid rock. The boat basin proper is about 1,200 ft. long.

The land wall is practically the same as the upper section of the river wall. As a compact gravel and sand foundation is found at the floor level, no sub-grade foundations are required, and it reaches only 18 ins. below the floor grade. This height is maintained for about 470 ft.; either side of this the solid rock excavation permits starting the wall at varying heights above the floor, so that its grade ranges from 1 to 31.5 ft.

On the upper side of the canal, on a bench excavated alongside the top of the wall or the excavation, a roadway is formed. This is to extend the full length of the canal. Where backfilling is required behind the wall it is made with loose rock, gravel and sand, and the roadway is graded on top of it.

The basin floor, where on a filled-in foundation, is of reinforced concrete, 12 ins. thick. At 3 ins. from the bottom of the layer are placed ⅝-in. round rods, laid longitudinally and transversely and spaced 12 ins. The floor is laid in 6-ft. strips across the basin. At these joints, and also at

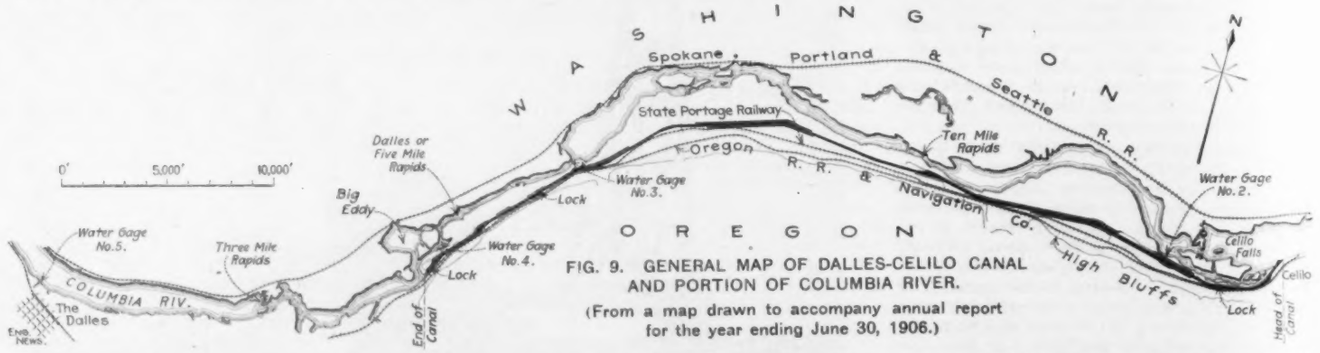

FIG. 9. GENERAL MAP OF DALLES-CELILO CANAL AND PORTION OF COLUMBIA RIVER.

(From a map drawn to accompany annual report for the year ending June 30, 1906.)

intervals of 8 ft. transversely, asphaltum-filled joints ¾ ins. deep are provided, to allow for expansion. Where the floor is laid in excavation no reinforcement is used. About 50% of the area of the floor is on a fill.

Bends in the course of the walls are made by single angles at the junction of the blocks, requiring odd shapes in only the two blocks joined.

while on duty. This will be on the line of the roadway, which will be graded up on each side to pass over the top.

In the lower bank, just above the upper gate, is an overflow wasteway weir, 54 ft. long. Shortly below the lower gate the 45-ft. straight section flares out into the 65-ft. section of canal, with side slopes of ¼ to 1.

ten years. The 108-ft. stage above the falls is about 15 ft. lower than that reached in 1894.

The top of the walls above the Celilo lock is fixed at Elev. 111, giving 3 ft. clearance above water in the canal and basin before navigation is stopped. Below the lock the level provided for is 99.5. It is not necessary to operate the lock until the surface elevation above it exceeds this

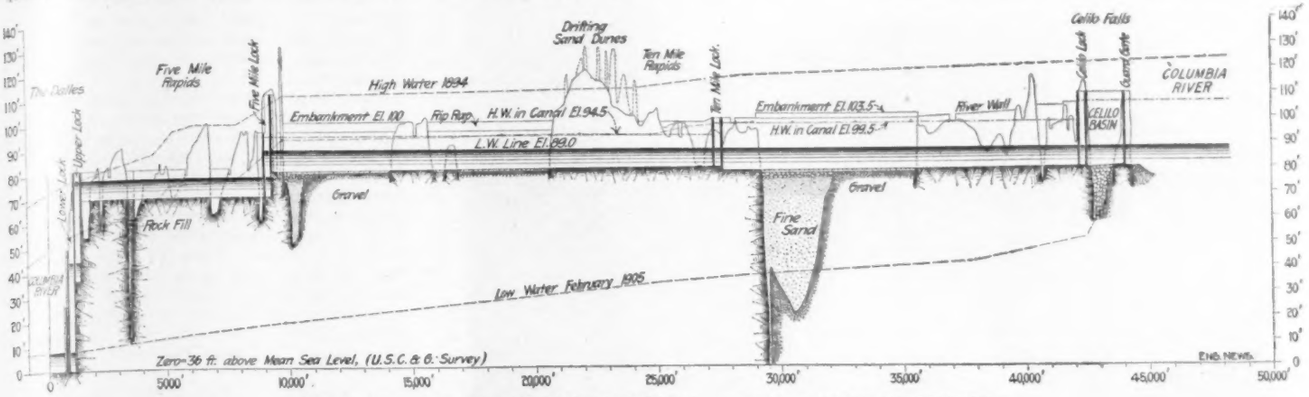

FIG. 10. PROFILE OF DALLES-CELILO CANAL, COLUMBIA RIVER IMPROVEMENT.

In building one of the upper blocks, having a total height of 33 ft., the form for the entire height is put up at the start. All the concrete is dumped from the overhead work trestle which is first built. The concrete is dumped into the hopper mouth of a vertical spout about 12 ins. sq. inside, which is made in 4-ft. sections connected by hooks. The sections first used were of sheet metal, but these were found to be inconveniently heavy, and the concrete adhered to their sides more readily than if made of wood, so that wooden sections were substituted. These are readily detached as the concrete is brought up.

The form has the four separate sections required by the four sides. The side sections have to be tied together at intervals, it being impracticable to secure the necessary stiffness to withstand the tamping without it. This is done by use of ⅝-in. iron rods at the necessary intervals These rods have to be left imbedded in the concrete. To avoid having to cut off the ends, each rod is threaded at each end to receive an end turnbuckle, the latter being a socket screw. The turnbuckles pass through the forms and over the ends of the rod, which latter lack 3 or 4 ins. of coming out to the surface of the concrete. When the form is taken apart, the turnbuckles are unscrewed and taken out, leaving only the holes in the concrete exposed, which are filled with mortar.

In moving the form, the two side sections are pulled forward, and, as the position for each set of rods moves past the end of the completed block, new rods and braces are put in, so that when past it the sides are properly connected and only the ends need handling. The sides are held apart by wooden braces, which are removed as the concrete is brought up to them.

The concrete is composed of Portland cement, sand and gravel in proportions of 1, 4 and 8. The sand and gravel are obtained by screening the material excavated for the basin. The exterior finish to the concrete is made, not by use of plaster, but by placing a mortar (composed of 1 to 3) behind a gage during the concrete work. The steel gage secures a thickness of 1 in. of the mortar between it and the form planking. The mortar is made quite "dry," in order that it will not be greatly penetrated by the adjacent green concrete when the gage is pulled out.

ADJACENT CANAL AND LOCK.—The first lock is located near the lower end of the first contract. It has the standard size of 45 × 300 ft. It is located in a solid rock excavation, and its concrete wall lining is battered 1 in 24. No wall is required to bring the sides up to Elev. 111, except just beyond each end of the lock. The total length of lock and approaches, including weir, is 520 ft.

Just above the lower gate of this lock a concrete room is to be built for use of employees

ARRANGEMENT AND OPERATION OF LOCKS.—In design of the canal and locks, an important factor was the stage of water at which the Cascade Locks (about 55 miles below Celilo), are drowned out. This occurs at about the 38.5 ft. stage on the gage at these locks. As through navigation on the Columbia is then stopped, it is not considered necessary for the Celilo locks to provide for any higher stage than this. Points corresponding to this stage have been located and platted on the profile of the Dalles-Celilo canal, and the design made accordingly.

The elevation of the lowest low water at the upper side of the falls is about 90, and allowance

height. When this occurs boats are locked down to or below this level in the lower canal. Below the lock the canal walls, instead of being dropped at once to the elevation permissible with the 99.5-ft. level, are lowered only gradually, in a distance of about 1¼ miles, in order to preserve a proper clearance above the 38.5-ft. Cascade stage in the river adjoining.

Along this slope are three inlets from the river, for maintaining the same depth when the river rises above the 38.5-ft. stage.

About 15,000 ft. below the first lock is the second one. The drop made here is about 5 ft. Lockage at this point is to begin when water on

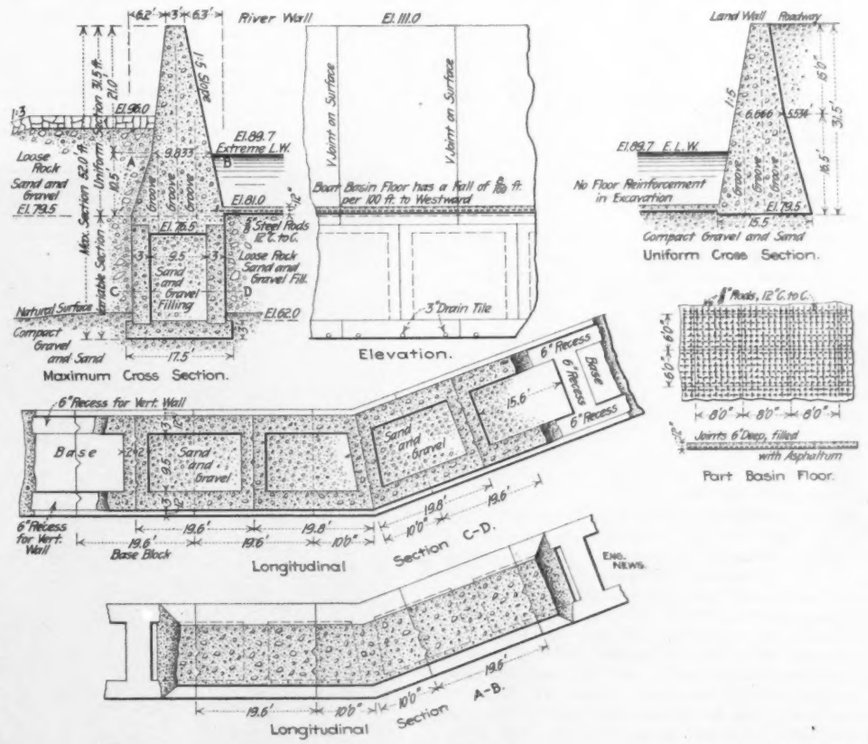

FIG. 11. DETAILS OF WALLS AND FLOOR OF BOAT BASIN, DALLES-CELILO CANAL, COLUMBIA RIVER IMPROVEMENT.

has been made for an 89-ft. stage. The limit of navigation has been fixed at 108 ft. elevation, which is about the Casade stage. The river observations for 25 years past show that the Cascade stage has been reached during about

its upper side exceeds elevation 94.5. As this is about 4 ft. above normal low water in the river above the falls, it may be observed that there is a considerable period in the low-water season when neither the first lock nor this one need be

operated, during which time boats can traverse the full seven miles below the head, with water at the level given by the river above.

Below the second lock the walls slope down parallel with the 38.5-ft. Cascades stage, reaching elevation 95.5 at ¼ mile, which is maintained to the next lock.

FIG. 12. FORMS FOR BLOCKS OF TOP SECTION OF RIVER WALL OF BOAT BASIN, DALLES-CELILO CANAL.

The third lock is located shortly below the head of Five Mile Rapids. Here the floor level is dropped 10 ft., to Elev. 70, and the normal water surface to Elev. 78. The 38.5-ft. Cascades stage drops away very rapidly below the canal level.

At the lower end of the canal are placed two locks in tandem. The first has a lift of 33 ft. and the second one has 37-ft.—its bottom being at zero elevation. The lower one is completely drowned out at a level considerably below the 38.5-ft. Cascades stage, but the upper one is then all that is needed, and it is free even up to the 1894 stage.

In the entire length of canal there are 12 overflow wasteways, for wasting any excess of water in the canal above its established high-water mark.

Referring to the two alternate plans before noted, the first plan, while it eliminates the lock at Ten Mile Rapids, makes it difficult to govern the "drowning out" of the canal at Cascade 38.5 ft. stage, and it is liable to cause a rapids in canal corresponding to Ten Mile Rapids.

The second plan more nearly follows the profile of water-surface at "drowning out" stage, and the drowning out is simultaneous from Celilo Falls to head of Five Mile Rapids. Below Five Mile the river drops away from the canal level very quickly, so the second plan is to facilitate drowning out the canal without endangering same below Five Mile Rapids.

CONSTRUCTION OF FIRST PART OF CANAL AND LOCKS.—The first part of the construction includes building the entrance canal from the Columbia, the guard gate structure, boat basin, first lock and a short section below, covering about 2,500 lin. ft. The lock gates and maneuvering machinery are not included. The work was advertised in August, 1905. The estimated cost was $373,675. Two or three different types of construction were covered by the proposals. In one, both plain and reinforced concrete were called for; in another one, only plain concrete; in still another, rubble masonry was to be used in place of concrete; and in another one the contractor was to supply plans, etc., for his reinforced-concrete and steel work.

As a result of the bids, it was decided to use only plain concrete for masonry. The contract was awarded on Sept. 5, 1905, to Smyth & Jones, of Portland. Following is a schedule of estimated quantities, with unit contract prices, all material to be in place:

33,000 cu. yds. plain concrete, at $5.33 per cu. yd.
81,000 cu. yds. solid rock excavation, at $0.90 per cu. yd.
12,000 cu. yds. sand excavation, at $0.18½ per cu. yd.
43,000 cu. yds. common excavation, at $0.37 per cu. yd.
9,000 cu. yds. hand-placed riprap, at $1.85 per cu. yd.
100 ft. B. M. oak timber, at $87 per M. ft. B. M.
1,500 ft. B. M. fir timber, at $37 per M. ft. B. M.
200 lin. ft. test and anchor holes, at $2.50 per lin. ft.
3,000 lbs. structural steel shapes, at $0.12½ per lb.
105,000 lbs. medium steel reinforcing rods, at $3.05 per cwt.
2,000 lbs. cast iron, at $0.12½ per lb.
2 roller valves, complete, at $2,400 each.
27 tons asphaltic cement, at $50 per ton.
1,000 lin. ft. drain tile, at $0.15 per lin. ft.

By common excavation is meant all classes of material between solid rock and sand, and on this work it is mostly gravel and earth. This contract called for completion by Dec. 31, 1906, but it will probably take until some time in 1908.

CONSTRUCTION OF ENTIRE CANAL.—Definite plans have been made for the remaining structures, but they are subject to revision. On the 6,400 ft. next below the contracted part it is estimated that 260,000 cu. yds. of solid rock and 15,000 cu. yds. of sand will be excavated. For the entire 8.4 miles of canal it has been figured that over 1,000,000 cu. yds. each of solid rock and common material will be moved.

Between the first and second locks is a stretch 1¼ miles long in which the entire excavation will be in gravel and sand. Along a portion of it a deposit of sand and quicksand reaches to a depth of 60 to 80 ft. below grade, which will probably require special construction. Between the second and third locks is another stretch of 2½ miles, all in sand and gravel. Both of these sections will, of course, be lined with concrete throughout.

Where in solid rock thorough cut no lining will be required, but where ravines are crossed a filling in of the bottom and the use of walls, as in the boat basin, will be necessitated.

In locating the center line of the canal, regular curves were run in, there being 14 of these, ranging from 2° to 6° and aggregating about 280°. However, as about all of the bends occur at boat or passing basins, where the channel is much widened, there will be no difficulty at all in turning the bends. In places the line follows depressions, and by locating the river wall on higher ground nearer the river the work is lightened at the same time that the passing places are formed.

The foregoing description and plans of the proposed work apply to the revised plans approved in May, 1908, these constituting what is unofficially known as the 1908 Project. This approval clears the way for contracting as much of the remaining canal as the appropriations will allow, and bids will soon be called for constructing about 14,500 ft. next below the first contract, extending to near the second lock. Everything will be included except the reinforced concrete lining in the sand and gravel section.

IMPROVEMENT OF THREE MILE RAPIDS.—A part of the general project includes the river improvement of Three Mile Rapids, between Big Eddy and The Dalles, already accomplished. This work consisted in the removal of rocks and reefs, most of which were below low water, the aim being to secure a channel 10 ft. deep at low water and nowhere less than 250 ft. wide, except at one place where it was made only 200 ft.

There are two classes of excavation: Class A rock, with cap above low water, and Class B rock, submerged. This work has been under way

FIG. 13. GENERAL VIEW OF SITE OF BOAT BASIN, DALLES-CELILO CANAL, SHOWING FOUNDATION OF RIVER WALL NEARLY COMPLETED.

under a contract with Robert Wakefield, of Portland, Ore., dated April 12, 1904, by which he receives $1.50 per cu. yd. for Class A and $6.25 for Class B, the approximate yardage being esti-

mated at 50,000 cu. yds. and 7,000 cu. yds. respectively.

ESTIMATED COST.—There has so far been appropriated by Congress for The Dalles-Celilo work a total of $750,000, including the $100,000 by the River and Harbor Act of March 3, 1907. By the latter an authorization of $500,000 additional, to be expended under the continuing-contract system, was given.

The amount expended to June 30, 1907, was $287,300. The Board of Engineers estimated that the cost would be $4,125,000, from which it appears that at least $2,875,000 is yet to be provided.

The present work is being carried out under general charge of Col. S. W. Roessler, U. S. A., and Mr. James S. Polhemus, Assistant Engineer. The work has been in immediate charge of Mr. Frederick C. Schubert, Assistant Engineer, to whom the writer is indebted for data from which this description has been prepared.

STUDIES OF THE PHYSIOLOGICAL CONTROL OF SEWAGE FILTERS, AT NEW BRITAIN, CONN.

By MILTON W. DAVENPORT.*

There are two general methods of filter control, the chemical and the bacterial. The one determines the purity of the effluent by a comparison of the nitrogenous and carbonaceous matter in it with that of the unfiltered sewage, and also the condition of the effluent with respect to its oxygen content and the effect that mixing with the body of water into which it is to be discharged will have upon its subsequent purification. The other is useful in determining the efficiency of the filters as a burying ground for the bacteria, especially the pathogenic forms. The stability of the effluent is also determined by the incubator test, which is in a way a combination of the two methods mentioned.

A third method is the physiological method. While in its present status it can hardly be called a method, still it deserves more study than has hitherto been accorded to it. It has been suggested that if an effluent will support the life of fish that this is a sufficient test of its purity. The significance of this test, however, is lost when we consider that fish do not directly depend upon the water for their food supply. Any water that is clear and contains sufficient oxygen for respiration, will support the life of fish no matter how much it may be polluted with organic material.

In the microscopic forms of life, the algae and the protozoa, and more particularly in the algae, we have organisms which depend directly upon the soluble content of the water for their food and sustenance.

During the year past these forms have been made the subject of considerable study at the laboratory of the Board of Sewer Commissioners of New Britain, Conn., with a view of determining, if possible, their relationship to the character of the water in which they were found, and thereby to obtain a clue to the character of a given effluent by the simple determination of the species growing in it. The problem has been succinctly stated by G. C. Whipple in his "Microscopy of Drinking Water," page 87, in the following words:

> An important question, and one which is of particular interest to water analysts, is the relation between the growth of organisms and the chemical analysis of the water in which the organisms are found. Unquestionably there is such a relation and we should very much like to be able to take up a chemical analysis and say this water contains such and such substances in solution and therefore such and such organisms may be expected to thrive well in it. In other words we desire to know better the nature of the food supply of the microorganisms.

The few investigations which have been made along this line have been based upon water supplies of a high degree of purity. In this paper it is proposed to record the organisms which have been found in water more or less polluted, such as sewage both before and after purification by filtration through beds of gravel. In order to obtain as much light as possible upon the food supply and environment of the organisms observed, a chemical analysis of both sewage and effluent was made. Care was taken to obtain a fair average result in the analysis. Samples were taken daily in the case of the effluent, and analyses of the sewage were made twice each month.

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DESCRIPTION OF FILTRATION PLANT.

Before giving in detail the data obtained, it will be of service to describe the filter plant. The city of New Britain, Conn., treats its sewage upon a gravel deposit situated in the town of Berlin. Thirty-one beds of one acre each were constructed with underdrains. Along one side of the beds runs an effluent ditch, into which all of the underdrains empty. This is an open ditch and carries the water to a brook. The sewage is treated by the so-called intermittent method. Each bed receives a dose of about 1,000,000 gals. of sewage every third day, or about 300,000 gals. per acre per day. The sewage, leaving all of its solid matter at the surface of the bed, and having a large part of its soluble impurities removed by the action of bacteria, passes down through 4 ft. of gravel to the underdrains and thence to the effluent ditch, which carries it to the Mattabessett River. Under ordinary conditions the dose of sewage floods the beds to a depth of about 6 ins., but owing to the porous nature of the filter, at the end of 4 to 8 hours all of the water has disappeared from the surface of the beds. With such heavy doses as the beds sometimes receive, however, the surfaces become compact and the water may take from 24 to 48 hours to disappear. Then the plow and harrow are used to loosen the surfaces of the beds again. Owing to the short period of time which the sewage remains upon the surface of the beds there is very little time for the organisms to grow in sufficient numbers to be observed. It may be said, therefore, that, from the standpoint of filtration, most of the forms which are described under sewage are found under abnormal conditions; that is to say, in sewage which has been standing for one or two days. In some instances the organisms collected from the beds are such as would be found in stagnant pools of rain water. The forms observed in the effluent, however, represent forms which thrive in a constantly running stream of water with little or no turbidity.

It will be convenient to divide the subject matter now into three parts: the first part will describe the organisms found in the sewage when it reaches the beds; the second, with the organisms which grow upon the surface of the beds, and the quality of their food supply; the third part will in like manner describe the organisms which grow in the effluent.

SEWAGE ORGANISMS IN THE OUTLET SEWER.

Several examinations of sewage taken from the main pipe line before it enters the beds were made. The results may be stated briefly as follows:

ALGAE.—The conditions of mechanical friction and abrasion, together with the absence of light, are highly inimical to their growth or even continued existence. The only forms recognizable were the Diatoms, and they were in a broken and battered condition. Some amorphous green matter was observed which might once have been the cells of some Chlorophyceae or Myxophyceae.

PROTOZOA.—The conditions of mechanical abrasion, and especially the lack of dissolved oxygen, are highly unfavorable to the life of these organisms. To sum up, fresh sewage may contain spores or organisms in the embryonic condition, but does not contain adult growing individuals. Septic sewage contains no algae, but may contain some forms of protozoa.

ORGANISMS ON THE SEWAGE BEDS.

The conclusions just stated must not be construed to mean that under favorable conditions organisms will not grow in highly polluted water. On the contrary, several species of algae and protozoa have been found under the conditions of quiescence already referred to. Furthermore, fresh sewage has been kept in a beaker in the laboratory, and has developed a large number of organisms, especially of the ciliated infusoria. The following is a list of organisms found in the sewage upon the surface of the beds.

ALGAE. — These included Chlamydomonas, Sphaerocystis and Ulothrix. Chlamydomonas grows abundantly throughout the year upon the surface of the water and is often blown by the wind into one corner of the bed. Ulothrix seems to be a sewage organism and is so described by Rideal in his work on "Sewage."

PROTOZOA.—These included Sphaerophyra, Euglena, Frontonia and Oxytricha.

ORGANISMS IN THE SEWAGE EFFLUENT.

The number of organisms found in the purified sewage as it flows in the effluent ditch are quite numerous both in point of numbers and genera. Some of the filamentous algae grew in such profusion as to necessitate the raking out of the ditch twice a month during the warm weather.

ALGAE.—These included Chaetophora, Myxonema, Draparnaldia, Closterium, Cosmarium Hydrodictyon, Scenedesmus, Ankistrodesmus, Tetraspora Tribonema, Melosira, Navicula, Gomphonema, Amphora, Oscillaria, Tetrapedia, and the fungus Leptomitus. By far the most abundant species was Tribonema, which grew in great masses throughout the warm weather; its place was taken in cold weather by Leptomitus. The other species seem to be of secondary importance.

PROTOZOA. — These included Hyalodiscus, Amoeba, Dactylosphaerum, Arcella, Nuclearia, Bodo, Mastigamoeba, Cercomonas, Anthophysa, Hexomitus, Colpoda, Uronema, Cyclidium, Carchesium, Zoothamnium. The most noticable species were Carchesium and Zoothamnium, which seemed to take the place of Leptomitus upon the advent of warm weather. The algae were identified according to the description of G. S. West, "British Fresh-Water Algae," while the protozoa were identified from the Report of the Fresh Waters of Connecticut by H. W. Cohn.

In order to arrive at some idea of the conditions of food supply upon which these organisms may be supposed to have thrived, the tabulated analyses of the sewage and effluent for the months during which they were observed, are now given.

LITERATURE BEARING UPON THE SUBJECT.

The literature on this subject is very scant. Whipple, in his work already quoted, has tabulated some of the factors which he considers of

ANALYSES OF CRUDE AND TREATED SEWAGE, NEW BRITAIN, CONN.
(Parts per Million.)

ANALYSES OF SEWAGE.

1907.	Total solids.	Loss on ignition.	Ammonia: Free.	Ammonia: Albuminoid.	Chlorine.	Nitrogen as: Nitrates.	Nitrogen as: Nitrites.	Oxygen consumed.	Temperature, Deg. F.
May	459	239	18.00	4.000	35.0	....	.....	45.0	53.0
June	424	204	10.50	3.000	33.0	....	.....	41.0	64.5
July	571	208	16.40	3.500	38.0	....	.....	50.6	70.0
August	430	231	10.50	3.000	38.0	....	.....	41.0	71.0
September	552	383	8.00	2.100	34.5	....	.....	35.2	64.5
October	576	282	7.00	1.570	37.5	....	.....	27.3	51.0
Average	502	273	11.60	2.360	36.0	....	.....	40.0	63.0

ANALYSES OF EFFLUENT.

May	330	160	3.785	0.490	26.8	4.76	.1140	4.31	49.0
June	363	113	3.936	0.420	32.5	3.37	.0594	4.35	66.0
July	271	120	4.563	0.438	29.0	3.73	.2020	5.58	77.0
August	284	131	3.729	0.572	28.6	3.80	.2565	8.54	73.0
September	363	172	1.602	0.405	29.6	7.54	.1670	5.17	64.5
October	437	132	1.738	0.328	29.0	3.77	.1888	3.85	54.0
Average	341	138	3.239	0.442	29.2	4.49	.1646	5.30	63.3

prime importance, but his work refers more especially to pure water. The views of Cohn, given by Tiemann and Gärtner, and more recently elaborated by Walker in England (Walker, 1902), however, are of especial interest.

Aside from the two sources mentioned there is very little of interest. Several organisms have caused trouble by clogging filters, odors, or for other reasons, and have received mention in these connections. Walker recognized three general classes, depending chiefly upon the amount of organic pollution present in the water. In pure water and highly purified effluents, the Chlorophyceae predominate; while in sewage and grossly polluted water Schizomycetes show the greatest growth. Between these two extremes are found the Myxophyceae. I have been able to confirm these results in a special manner. During the summer, nitrification is very active in our filters, while in cold weather it is greatly diminished and in some filters it practically ceases. There is then a seasonal change in the character of the effluent. In comparing the species which were found at different periods of the year in the light of this fact it was noted that in cold weather Schizomycetes and some fungi are predominant, and that as warm weather advances the cycle is completed by the ascendancy of the Chlorophyceae.

GENERAL CONCLUSIONS AND SUGGESTIONS.

Reasoning from analogy, different species of algae must require different conditions of food supply, and environment. I wish to designate by the term optimum environment such conditions of temperature, amount and nature of the soluble content of the water, color and such other factors (as quiescence, movement, etc.) as shall in the future be shown to be necessary concomitants, and as shall enable the species to reach its highest development.

If we could determine the optimum environment for a sufficient number of species it would be possible to tell at once from a microscopical examination the character of a given effluent. While the classification of Walker's is convenient as a starting point for future work, a study of the occurrence of various species leads me to believe that it is not a hard and fast one. Rather that some species of the Chlorophyceae approach in their optimum environment that of some of the Myxophyceae, and so on. For example, Chlamydomonas, which was noted by Hollis growing in a certain public water supply, had been found to grow in abundance in fresh sewage. This may mean either that a given species can grow in waters of widely different character, or that the essential factors determining the optimum environment are the same in the several waters.

In order to arrive at the optimum environment of a given species two methods offer themselves. The field method, which consists in the determination of the species found in a given source with notes on the relative amount of growth, luxuriance; together with a physical and chemical analysis of the water. Finally, a statistical comparison of the data obtained. It is obvious that a large amount of data must be accumulated before this method can become fruitful. The data in this paper must be regarded as a mere starting point. It is hoped, however, that they may be multiplied until it is possible to reach results.

The second method is the laboratory method; and the end may be accomplished by the artificial feeding of species. While this method may yield valuable results, on the whole, in spite of the labor involved, it is believed that the first method promises the best for the solution of the problem.

PERMEABILITY TESTS OF CONCRETE WITH THE ADDITION OF HYDRATED LIME.*

By SANFORD E. THOMPSON,† M. Am. Soc. C. E.

These permeability tests were made to determine the effect of adding various percentages of hydrated lime to concrete of different proportions. The specimens were similar in a general way to those designed by the writer for previous tests,‡ but were of much larger size; in fact, they were considerably larger than have hitherto been customary in permeability tests. The blocks of concrete were 20 ins. in diameter by 16 ins. thick, and the water was introduced into the center of the block as described and illustrated in this paper.

The proportions of concrete selected were those which are customarily used in concrete construction, except that a slight excess of sand was taken in proportion to the stone to insure homogeneous specimens, thus avoiding the possibility of stone pockets which are more liable to occur in small-sized specimens than in practical construction.

The materials, which are more fully described later in the paper, are quite representative so

FIG. 1. VIEW OF TEST PIECES UNDER WATER PRESSURE.

that the results obtained are applicable to usual conditions in construction work. The cement was Lehigh brand; the crushed stone was conglomerate rock, which resembles trap in its characteristics and tests; the sand was bank sand of good average quality. The hydrated lime was Pine Cone brand made by the Rockland-Rockport Lime Company of Rockland, Maine.

The percentages of hydrated lime to add were selected after a careful study of the materials and the proportions, the plan being to use larger percentages of lime with the leaner concrete mixtures because these contained more voids to be filled. The proportions of concrete and the percentages of lime selected by this preliminary study were as follows:

Concrete, one part cement, 2 parts sand, and 4 parts stone, with respectively 0%, 5%, 7½% and 10% hydrated lime.

Concrete, one part cement, 2½ parts sand, and 4½ parts stone, with respectively 0%, 7½%, 10% and 14% hydrated lime.

Concrete, one part cement, 3 parts sand, and 5 parts stone, with respectively 0%, 8%, 14% and 20% hydrated lime.

The tests were laid out by the writer at the request of the Rockland-Rockport Lime Co., and were made by the Boston Elevated Ry. Co. in their Cambridge Laboratory. The scheme of tests was approved by Mr. W. E. Healey of the Rockland-Rockport Co. and by Mr. George A. Kimball, Chief Engineer of the Boston Elevated Ry. Co., and the results are here presented with their permission.

CONCLUSIONS.—The following conclusions are drawn as the result of the experiments:

(1) Hydrated lime increases the water-tightness of concrete.

(2) Effective proportions of hydrated lime for water-tight concrete are as follows:

For 1 part Portland cement: 2 parts sand: 4 parts stone, add 8% hydrated lime.
For 1 part Portland cement: 2½ parts sand: 4½ parts stone, add 12% hydrated lime.
For 1 part Portland cement: 3 parts sand: 5 parts stone, add 16% hydrated lime.

These percentages are based on the weight of the dry hydrated lime to the weight of the dry Portland cement.

(3) The cost of large waterproof concrete structures frequently may be reduced by employing leaner proportions of concrete with hydrated lime admixtures, and small structures, such as tanks, may be made more water-tight.

(4) Lime paste made from a given weight of hydrated lime occupies about 2¼ times the bulk of paste made from the same weight of Portland cement, and is therefore very efficient in void filling.

Although the character of the sand and stone used in the concrete will affect the best percentage of lime to use, the present materials are representative of average materials throughout the country so that the results should be of general application. Coarser sand would naturally require slightly larger percentages of lime, and finer sand, that is, sands having a larger percentage of fine grains which pass a sieve with 40 meshes to the linear inch, would be apt to require less lime, since sands containing considerable fine material produce a more water-tight although a weaker concrete.

A study of the curves which are given later in the paper suggests that for coarser sands than used in the experiments, or in cases where the water pressure must be applied in one month or less after laying, that the percentages given above may be increased by about ¼, while for many classes of work ¼ less than the above percentages will be satisfactory.

For mortar in proportions corresponding to the cement and sand in the different concretes the same percentage of hydrated lime would naturally be selected: thus 1:2 mortar corresponds to 1:2:4 concrete; 1:2½ mortar to 1:2½:4½ concrete; 1:3 mortar to 1:3:5 concrete.

Increasing the proportions of stone, say to 1:2:4½, 1:2½:5 or 1:3:5½, should have no effect on the percentage of hydrated lime to select, but for water-tight concrete it is always advisable to have a slight excess of mortar to avoid stone pockets.

RESULTS OF EXPERIMENTS.

The specimens ready for testing are shown in the photograph, Fig. 1. The water is introduced into the middle of the concrete cylinders. As it enters the specimen the pipe is enlarged so that an area of 12½ sq. ins., that is a circle 4 ins. in diameter, is exposed to the water, and the water to escape must flow through 8 ins. of concrete.

In the accompanying table the results of the tests are given in detail, while the curves in Fig. 2 also present the effect of the hydrated lime upon the water-tightness of the concrete.

*Paper read before the annual meeting of the American Society for Testing Materials, June 23-27, 1908, Atlantic City, N. J.

†Consulting Engineer, Newton Highlands, Mass.

‡See Proceedings of the American Society for Testing Materials, Vol. VI. (1906), p. 373.

The percentages of hydrated lime are based on the weight of the cement, these being added to the cement and not replacing it. The variation in the ages of the specimens in different proportions slightly affects the results and accounts in part for the fact that the 1:3:5 mixtures in the pressure tests are nearly as water-tight as the richer proportions. Specimen No. 5, which shows practically no flow, is evidently erratic.

The specimens were first subjected to a head of 7 ft. by filling the vertical pipes with water, and while the results of these preliminary tests are of small value because the pressure in most cases was not enough to force the water through

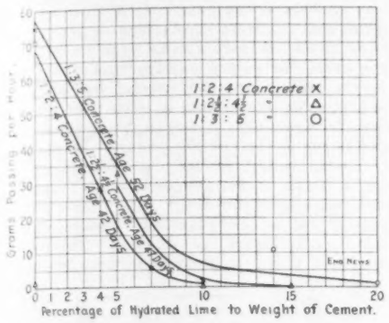

1:2:4 Concrete X
1:2½:4½ " △
1:3:5 " ○
1:3:5 Concrete, Age 28 Days
2" 1:2:4 Concrete, Age 42 Days
1" 1:2:4 Concrete, Age 42 Days
Eng. News
Grams Passing Per Hour
Percentage of Hydrated Lime to Weight of Cement.

Fig. 2. Curves Showing Increased Impermeability with Increase of Hydrated Lime Content.
(Flow through 8 ins. of concrete under 60 lbs. water pressure.)

the specimen, the quantity being measured before entering the concrete, the results are given in the table, column 5, as confirming in a general way the tests of the concrete under city pressure. These tests under 7 ft. head, column 4, were maintained for several days and the flow was recorded each day, the average only being given in column 5.

After a longer period of setting, varying from 40 to 53 days, the specimens were connected with the city water pressure, which averaged 55 to 60 lbs. per sq. in. Before measuring the flow, the pressure was maintained for several hours (column 7) to equalize the flow, and then the flow was measured for a period of several hours and recorded in grams per hour.

The flow given in grams per hour is very nearly the same as the flow expressed in ounces per 24 hours.

The curves in Fig. 2 are plotted from the table. The result from one specimen, the 1:2½:4½ mix with 0% hydrated lime, is erratic, and this test is omitted in making up the curves. All of the tests show some variations in the lower portions of the curves, but when the flow through the specimen is as small as 10 grams per hour, which is approximately equal to about 8 ounces or ½ pint per 24 hours, the concrete is so nearly water-tight that slight variations are unavoidable. The curves are based on a study of all of the tests.

The pressure, nearly 60 lbs. per sq. in., which is equal to a head of about 140 ft., is unusual in engineering construction. Previous tests* have shown that flow through concrete is almost directly proportional to the pressure, so that for lower pressure the flow will be correspondingly less. The thickness of the concrete was only 8 ins. and water-tightness increases greatly with the thickness.

In selecting the best percentages of hydrated lime for the different proportions of concrete, these points, as well as the fact that the 1:3:5 specimens are slightly older than the others, have been taken into account, and as a result of this study proportions suggested for general practice are 8% for 1:2:4, 12% for 1:2½:4½, and 16% for 1:3:5 concrete, these percentages of lime being based on the weight of the cement. As stated, smaller percentages than these, for example, 6% for 1:2:4, 9% for 1:2½:4½, and 12% for 1:3:5, give results which should be satisfactory for many conditions in practice, while

*By Fuller & Thompson, Transactions of the American Society of Civil Engineers, Vol. LIX., p. 133.

TABLE SHOWING PERMEABILITY OF FLOW OF WATER THROUGH CONCRETE 8 INS. THICK.

		Flow of water under 7-ft. head.			Flow under pressure of 60 lbs. per sq. in.			
Mark.	Per cent hydrated lime.	Age, days.	Duration of measured flow, hours.	Flow grams per hour.	Age, days.	Pressure applied before measurement, hours.	Duration of measured flow, hours.	Flow, grams per hour.
1:2:4 concrete:								
No. 1	0%	18	161	2.7	40	24	4¾	74.8
" 2	4	18	161	1.2	41	18	5	28.4
" 3	7	18	161	1.0	42	18	6¾	5.2
" 4	10	15	161	1.0	46	6	18	1.6
1:2½:4½ concrete:								
No. 5	0	30	169	0.3	44	17	6	1.1
" 6	5	30	169	1.9	45	18	6	32.5
" 7	10	29	169	0.8	49	..	21	0
" 8	14	29	169	0.7	50	..	27	0
1:3:5 concrete:								
No. 9	0	26	169	9.8	50	6	14	70.6
" 10	8	26	169	1.1	51	8	17	3.6
" 11	14	28	169	1.1	50	28	13	10.7
" 12	20	28	169	1.2	53	9	15	0.7

in certain cases a larger percentage may be chosen.

Frequently it is advisable to make special studies or tests with the materials available to determine the best percentage.

The sand was ordinary New England bank sand and the crushed stone was conglomerate or pudding stone whose quality and general characteristics for concrete are similar to trap.

The mechanical analyses of the aggregates are as follows, the sizes of grains being given as the total per cent. passing the various sieves:

TABLE SHOWING MECHANICAL ANALYSIS OF SAND USED IN TESTS.

		Total per cent. passing.	
No. of sieve.	Width of mesh of sieve. ins.	Sand.	Stone.
2-in.	2.00	...	100
1½-in.	1.50	...	92
1-in.	1.00	...	76.8
½-in.	0.50	...	48.8
¼-in.	0.25	100	12.6
No. 5	0.16	97	1.8
" 12	0.0583	75.8	1.8
" 20	0.0335	59.7	1.3
" 40	0.0148	25.7	1.1
" 100	0.0055	4.0	0.7
" 200	0.0030	1.8	0.4

MAKING THE SPECIMENS.—The apparatus was designed before making the specimens and full directions covering the details of the measuring and mixing of the materials and the making of the specimens were prepared in writing and sent to the laboratory of the Boston Elevated Ry. Co., the tests being made by Mr. C. B. Edwards, Asst. Engineer. A working drawing of the specimen as molded with the apparatus required is shown in Fig. 3.

Instead of using a wooden mold, the sides were formed by two pieces of wrought iron bent to half circles and bolted together. These rested

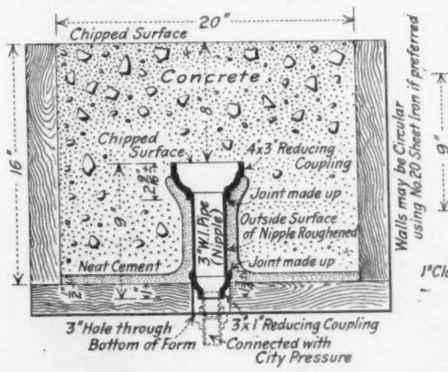


FIG. 3. DETAIL OF TEST PIECE.

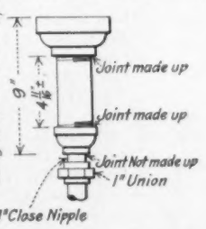
on a plank platform to form the bottom of the mold until the concrete had set.

The proportions were based on volume measurements, assuming 100 lbs. cement to the cubic foot, but for greater accuracy in making the tests the weights per cubic foot of the sand and stone were determined and the measurements made by weight. The cement and hydrated lime were first thoroughly mixed to a uniform color, by passing several times through a ⅛-in. sieve, then the sand was added and mixed dry. The stone was finally added and sufficient water used to make a soft, mushy mix, such as would be adopted in construction. The mixing was very thorough, but no more so than would be expected in practice with the ordinary types of concrete mixers.

Since previous tests by the writer showed that the top of a block as molded is much more water-tight than the bottom because of the fine material which rises to the surface, the specimens were made in an inverted position so that Fig. 3 shows the specimen upside down when compared with its position in the permeability test. The iron pipe fittings were placed upright in the molds, as shown, fittings which were easily obtainable being selected to cheapen the cost. These were so placed as to give a thickness of 8 ins. of concrete in all directions, and a surface for the water to strike against of 12½ sq. ins., that is, a circle 4 ins. in diameter. The fittings were filled with sand before placing the concrete and the top covered with oiled paper to prevent the concrete getting into the pipe.

The bottom of the mold was covered with a thin layer, about ½ in. thick, of neat cement, and neat cement was also plastered around the fittings which had first been thoroughly cleaned with acid and then washed and scraped with a brush, thus forming a perfectly tight joint. There was no leakage in any of the specimens, in fact, it would appear that it is unnecessary to insert the pipe so far into the specimen, 2 or 3 ins. probably being sufficient.

When the concrete had hardened, the sand and oiled paper were removed from the pipe and the surface chipped free from mortar down to the clear concrete, the large size of the fittings permitting a chisel to be readily worked. The top of the specimen as molded was also chipped down so that the stones were exposed in the surface of the concrete. When ready to test, each specimen was supported by 2 × 4-in. pieces of studding, which are shown in Fig. 1, and the fittings connected with a pipe passing up through the ceiling to the floor above. Before connecting, the fittings were filled to a depth of about 3 ins. with sand thoroughly washed and screened to about 30-mesh size. A funnel 24 ins. at the top reducing to a size of the neck of a large bottle was suspended under each specimen to collect the water that might pass through the specimen. The concrete in each specimen weighed over 400 lbs.



PROPORTIONING THE HYDRATED LIME.—Few tests have been published to determine the effect of the introduction of special materials into concrete to increase its water-tightness. The percentages of hydrated lime to use were determined by applying the conclusions derived from tests with graded concrete aggregates and the results of the tests indicate that mechanical analysis methods can be applied to the laying out of permeability tests.

For the 1:2:4 proportions the percentages of hydrated lime were selected partially by judgment. From previous tests by the writer, 2% of hydrated lime had been found to increase the water-tightness of 1:2:4 concrete made with sand and gravel, and 4% of lime to still further increase it. The minimum percentage was therefore selected as 4%, and the maximum percent-

age for the 1:2:4 mix was taken as 10%, so as to confine the results to comparatively narrow limits. One intermediate percentage was also chosen, thus giving 0%, 4%, 7% and 10% for the 1:2:4 concrete.

Leaner concrete mixtures evidently require more fine material for water-tightness because there are more and larger voids. Furthermore, tests in general indicate that with a lean mix we can add much more fine material without reducing the strength, and that this addition up

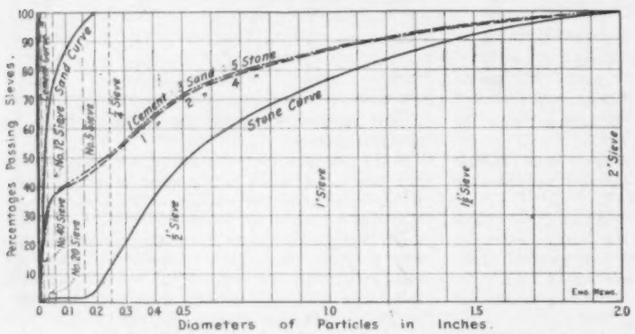


FIG. 4. MECHANICAL ANALYSES OF CONCRETE MATERIALS AND MIXTURES.

to a certain limit is beneficial not only for water-tightness but also for strength.

For selecting percentages of lime for the 1:2½:4½ and the 1:3:5 concrete which would compare with the percentages selected for the 1:2:4, methods of mechanical analysis were employed, the object being to obtain mixtures for each of these other proportions which would have substantially the same sizes of particles. In Fig. 4 the mechanical analyses of the cement, sand and stone are plotted and a combination curve of these three materials made for 1:2:4 and 1:3:5 concrete. The combined curves are simply the mechanical analyses of the mixture of the three dry materials in the given proportions.*

The curves of the individual materials indicate the percentages passing the sieves of various sizes. For example, taking the curve for the broken stone, which is the lower curve, all the stone or 100% passes a sieve 2 ins. in diameter, 92% passes a 1½-in. sieve, 76.5% a 1-in. sieve, and so on. The sand and cement curves are plotted in a similar fashion.

Having plotted these individual curves, it is possible to calculate the percentages and plot combined curves showing mixtures of these three materials in any given proportions.

The making of these combined curves is quite simple. Thus, for example, to find the point on the 1:2:4 curve where it cuts the ordinate corresponding to the No. 12 sieve, the sums of the percentages of the individual materials at this same ordinate are taken in the proportion which they bear to the concrete mixture. All the cement is finer than the No. 12 sieve and since the cement is one part of the 7 parts in the mixture, 1/7 of 100% represents the percentages of cement in the mixture at the given ordinate. Similarly, since there are 2 parts of sand in the 7 parts, the sand percentage at the No. 12 ordinate, 70%, is multiplied by 2/7 and the stone per cent., 1.8%, by 4/7, thus giving as the point on the No. 12 sieve ordinate in the combined curve:

$$1/7 \times 100\% = 14.3\% \text{ for cement.}$$
$$2/7 \times 70\% = 21.7\% \text{ for sand.}$$
$$4/7 \times 1.8\% = 1.0\% \text{ for stone.}$$
$$37.0\% \text{ for 1:2:4 mix.}$$

The other points in the curves are found in a similar manner.

Permeability depends more upon the gradation of the fine particles than of the coarse, and the finer material, that is, the left-hand portions of the curves, is therefore replotted in Fig. 5 to larger scale. Referring to the curves for 1:2:4 and 1:3:5 proportions, we notice that they are quite similar above, that is, to the right, of the No. 20 sieve, and that the greatest proportionate difference between them is below the No. 40 sieve. We may assume therefore that the particles lying below the No. 40 sieve are those which chiefly affect the water-tightness. Therefore, the finer sieves, No. 100 and No. 200, must be chiefly used in studying the percentages of lime to add.

Several percentages were tried in plotting, and it was found that to make the 1:3:5 curve most nearly similar to the 1:2:4 concrete, with 10% hydrated lime, 20% of lime must be added to the 1:3:5 mix. The curves of these two mixtures together with the curves of concrete with no lime are shown in Fig. 5. The other proportions were also plotted in the same way, but are omitted in the diagram for the sake of clearness.

The intermediate proportions for the 1:3:5 mix were thus determined upon as 8% and 14%, while for the 1:2½:4½ proportions, 0%, 6%, 10% and 14% were found to correspond with the selected proportions for 1:2:4.

Since a given weight of hydrated lime makes more than twice as much paste as the same weight of cement, the lime percentages are doubled when combining them with the other curves. One pound of hydrated lime made into a paste occupies about the same volume as 2¼ lbs. of cement.

CONSTRUCTION OF WATER-TIGHT CONCRETE.—A paper on permeability is incomplete without reference to the general principles of construction which must be followed to produce a water-tight concrete. The concrete materials may be perfectly graded and the proper proportions of cement and of hydrated lime used, and then if the concrete is poorly mixed, mixed with insufficient water, or improperly placed, or if joints are left in the mass, the wall will invariably leak.

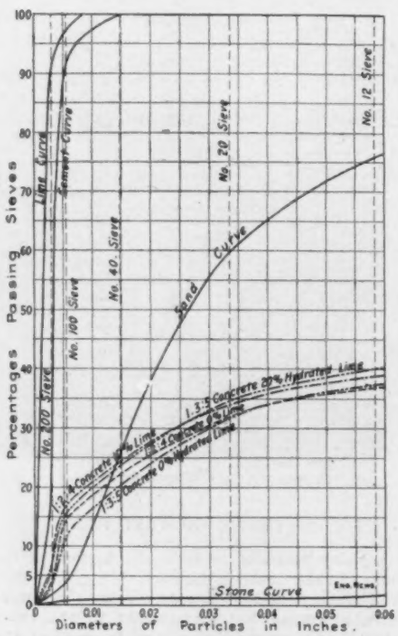


Fig. 5. Mechanical Analyses of Mixture with Hydrated Lime Additions.

In the first place, the mixture must be thorough, and, in the second place, sufficient water must be employed to give at least a "mushy" mix, so that it will settle into place with only a small amount of ramming.

Fully as important as the mixture is the bonding of the concrete between two days' work. For a small structure which must be water-tight, it is advisable to place the concrete continuously, allowing no joint whatever, and not even permitting the concrete to stiffen up between the batches. Even an interruption of an hour in the middle of a hot day has been known to form a joint which will allow water to pass. If continuous work is impracticable, the old surface of the concrete must be thoroughly cleaned of all dirt and laitance or partially set cement, so as to expose the concrete. A layer of neat cement paste of soft consistency or else of 1:1 mortar should be then spread upon the old concrete after thoroughly wetting it, and the new concrete laid before this mortar has stiffened. The placing of the mortar or paste does not preclude the necessity of thoroughly cleaning the surface, for if any of the laitance or partially set cement is left on the old concrete, it will form a joint under the new mortar through which water will pass.

A long wall or a conduit may require longitudinal reinforcement to prevent temperature cracks and therefore leakage through them.

*For description of mechanical analysis methods by William B. Fuller, see Chapter XI. in Taylor and Thompson's "Concrete, Plain and Reinforced"; also paper on "The Laws of Proportioning Concrete," by Fuller and Thompson in Trans. American Society of Civil Engineers, Vol. LIX., p. 67 (1907).

THE NAVIGATION OF HUDSON BAY.

In our issue of June 25 we commented on the revival of the Hudson Bay route agitation and remarked that it was extremely doubtful whether it ever could be made a commercial success. The Boston "Transcript" of July 18 prints an interview with the captain of the Hudson Bay Company's steamer "Pelican," which sheds an interesting light on the climatic difficulties which beset commerce by that route. The captain has sailed the Hudson Bay for 37 years and is quoted as follows:

"In the first place," said he, "trade through the Hudson's Bay would never pay. You would have to build special steamships for the trade, steamships which would be no good for any other place. That would mean lying idle for eight or nine months in the year.

"At all times of the year there are dangerous icebergs floating down from the North and carried into the Straits by the rush of the sea, and the steamer must be strong enough and slow enough to withstand all kinds of knocks. That is, speed must be sacrificed to get sufficient solidity."

For not more than three months of the year is the great sea of Northern Canada open to navigation. Not until after the middle of July could any navigator be certain of finding a passage at all; for weeks after that he would be met by a rush of heavy bergs loosened out from the bay. By the end of September it was time for vessels to get out to the open sea or run a large chance of being closed up for the winter. This actually happened to one of the Hudson's Bay Company's vessels two summers ago. When the steamer was headed out of the bay, the Straits were found to be choked with field ice, so the craft had to sail for the most convenient port and lay up for eight months.

Closing off in September or even in by the middle of October means that no grain of the one season would get out before August of the following year. Elevators and many other appliances would have to be provided. Boats suitable for the trade would make their European port in a month, more or less, after that.

The harbors of the two great seas, James Bay and Hudson's Bay, are very poor. The whole coast has been explored, and at the head of two indentations on the southwestern coast, the Hudson's Bay Company have established posts, York and Churchill. Fort Churchill is fairly open, a draft of 19 ft. being available pretty well into the harbor, but York Roads are so shallow that at times the "Pelican" of 600 tons has to anchor eight miles out. James Bay is also too shallow for navigation by ocean liners.

The Hudson's Bay Company's fleet consists of three vessels about the size of the "Pelican." Each makes one trip in a year. There is also a French company which sends a small vessel in a couple of times in the year.

The "Pelican" is propelled largely by canvas. She could not carry enough coal to last her on the long journey from London up along the Labrador coast, through the Straits and across the bay and then back across the North Atlantic to London with her cargo of furs. So she uses steam only in calms and through the ice.

THE LIGHTING OF THE WASHINGTON UNION STATION, WASHINGTON, D. C.*

The requirements followed in the lighting of the Washington Union Station, recently completed, are of more than passing concern, and it is therefore of interest to describe some of the methods employed in attaining the desired ends. The new terminal property consists of the Union Station, the Express Building, occupied by the Southern, Adams and United States Express companies, the power plant, locomotive and car-repair shops, coach yard and several signal towers. The relative locations of buildings, tracks and streets were shown in Engineering News, Nov. 10, 1904, in connection with the general work of the terminal improvement.

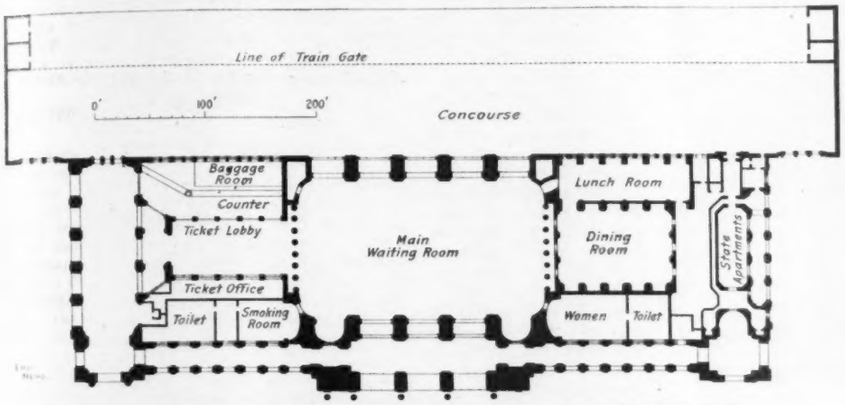


FIG. 1. PLAN OF FIRST FLOOR, UNION STATION, WASHINGTON, D. C.

The power plant supplies electric current for light and power, steam for heating, compressed air for cleaning, brake testing, signaling, etc., and water for drinking, house service and fire protection, to the Union Station, Express Building and to the adjoining yards, and also light and power to the coach yard, repair shops and signal towers. Separate power plants furnish heat, compressed air and water to the shops and coach yard.

The high tension distributing system for incandescent lighting and power purposes is operated at 2,300 volts and 60 cycles. Each transformer for lighting purposes and each set of transformers for power purposes is served by an independent cable direct from the switchboard at the power-house. Cables for arc service have either four or eight conductors and serve from two to four loops. All motor-driven apparatus is operated from three-phase lines while all incandescent lighting service is taken from one phase of the generators.

The transformers are placed in fireproof vaults located at convenient points in the basement of the various buildings. The vault walls are of brick and are built solid from the floor to the ceiling. The floor space generally covers an area of about 100 sq. ft., giving sufficient room for the changing of transformers and parts without disturbing the transformers in service. Vault doors are iron, lined with asbestos, and are of sufficient height and width to facilitate the removal of apparatus. The high-tension cables in each vault terminate at a set of disconnecting switches mounted on the wall above the transformers. Expulsion type fuses are installed between the switches and transformers. Low-tension feeder distributing panels, encased in ¼-in. sheet-metal cabinets, are mounted on the outside of the vault walls at either side of the door, connection to the transformers being made through iron pipe conduit. Three-wire, 113-226-volt feeders are run from the feeder cabinets to distributing cabinets located at convenient points throughout the buildings, each feeder serving from one to five or six distributing cabinets.

After a number of distributing cabinets had been installed a change was made in the District regulations to permit the grounding, under certain conditions, of all electric fixtures not connected to gas piping. The general scheme of wiring was accordingly changed to profit by this change in regulations. Insulating joints are eliminated entirely. The neutral wire of the branch circuits is grounded to the conduit system at both the fixture outlet and the distributing cabinet—at the latter by means of a copper wire running entirely around the panel in the wiring space and connected with each neutral wire and the conduit system. The neutral wire of feeder circuits is also grounded to the conduit system at cabinets and at transformers by means of a ground plate laid in charcoal under the vault floor. Neutral fuses in all feeder circuits are eliminated and solid copper bars are substituted.

The station, passenger concourse and train sheds cover a ground space of more than 18 acres. Thirty-three tracks, served by 19 platforms, enter from the north; 12 tracks merge into two, which continue to the south under the station and through twin tunnels running between the Library and Capitol under First St. The subbasement and concourse basement are used for handling baggage. The station basement is occupied by a portion of the ventilating and other service machinery and by several transformer vaults, the balance of the space being held in reserve for future requirements. The first or street floor is occupied by the main waiting-room, ticket offices, baggage-room, dining and lunch rooms, womens' room, smoking-room and state apartments. The kitchen is located on the second floor. The balance of the second floor, the third, and a part of the attic floors are used for office purposes. A plan of the first floor is shown in Fig. 1.

The lighting of the large floor areas is generally by series, direct-current arc lamps. All other lighting, except for the ticket lobby, is from "metallized," carbon-filament, incandescent lamps. In this one exception tungsten-filament lamps have been installed. The particular features of the lighting of different parts of the Union Station are taken up in the following divisions.

MAIN WAITING-ROOM.—The large general waiting-room, shown in Fig. 2, covers a floor space 120 ft. wide by 230 ft. long, and has a barrel-shaped ceiling of 60-ft. radius, the highest point of which is about 98 ft. from the floor. A series of five alcoves which form the galleries over the entrance vestibules, run along the sides of the room, with colonnades connecting the galleries across the ends of the room. The ceiling is light in color and is decorated with gold leaf. In the preliminary design of the main waiting-room it was decided to use some system of lighting by which the fixtures and lamps would be concealed.

Banks of special, inverted, series, arc lamps are placed in the alcoves and back of the balustrade on top of the colonnades, with corrugated mirror reflectors behind them to throw the light to the ceiling whence it is diffusely reflected to the floor. As an aid to the reflectors, magnets blow the arc towards the waiting-room. To soften the light and to eliminate the bluish-white tint, characteristic of arc lamps, "cathedral glass" screens of a very light yellow tint are placed over the lamps and reflectors. Fig. 3 is a rear view of the arc and reflector bank in a single alcove. The inverted-lamp mechanism is shown by Fig 4. Fig. 5 is a section through one of the projector units.

The total equipment comprises 162 lamps so arranged that several combinations of the number in service may be had. A series of luxometer readings were taken with all possible combinations of lamps, and from the results of these tests it was found that the corrugated reflectors and light colored ceiling give almost perfect diffusion, that with all lights burning, at reading distance from the floor (about 42 ins.) the illumination is practically uniform. Curves showing the relative degrees of illumination in north-south and east-west directions are nearly straight lines. The illumination values vary

FIG. 2. WEST END OF THE MAIN WAITING-ROOM, UNION STATION, WASHINGTON, D. C.

*Arranged from information supplied by Mr. Ivy L. Lee, Pennsylvania R. R. Co., 85 Cedar St., New York City.

from 2.5 candle-feet in the corners of the room to 2.3 candle-feet in the center, thus the need of auxiliary lighting on the seats for reading is eliminated. The avoidance of such auxiliary fixtures was desirable to preserve the harmony in color and arrangement of the general architectural treatment. Difficulty was experienced in procuring glass to properly soften the color of the light without absorbing too much of one or all colors. With "cathedral glass" and clear inner globes a loss of only 16%, of the total from the arc was found. This figure is less than with an opal inner globe alone. The light is a very close approach to daylight, and gives practically true color values in every part of the spectrum.

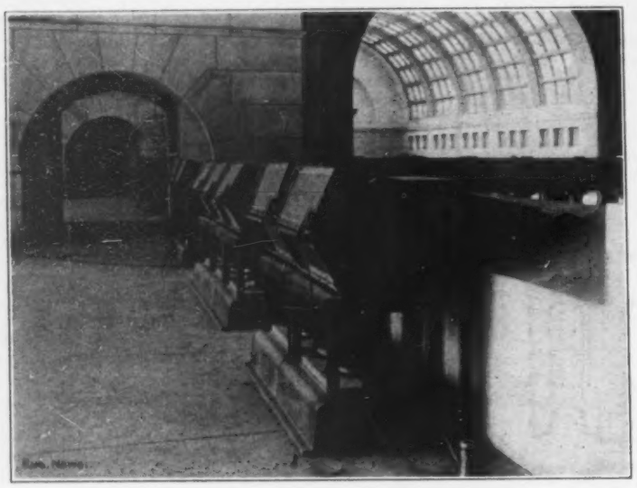


FIG. 3. BANK OF INVERTED ARC LAMP PROJECTORS, USED FOR LIGHTING MAIN WAITING-ROOM, WASHINGTON UNION STATION.

TICKET LOBBY.—The ticket lobby, located at the west end of the waiting-room, and shown in Fig. 2, is approximately 100 ft. long by 50 ft. wide, with a barrel-shaped, skylight ceiling for natural lighting in the daytime. At first the use of a system of lighting similar to that in the waiting-room, but with smaller units, was considered. A study of the conditions and tests of the skylight glass indicated that it would be less expensive both in construction and maintenance to install individual lamps above each skylight. Two hundred and twenty-five tungsten lamps, 100-watt, 80-c. p. size, are used with metal reflectors, covered inside with aluminum paint. The lamps are arranged on four three-wire circuits, controlled by single pole switches, so that half the lights may be cut out of service without losing the symmetry of the lighted panels. The lamps are all used in a pendant position and the reflectors are of a special design, mounted so as to direct the light towards the axis of the barrel ceiling. The illumination in this portion of the station averages about 2.3 candle-feet, the quality of the light closely approximating that in the adjoining main waiting-room, and the distribution being equally as good.

BAGGAGE-ROOM.—The baggage-room on the first floor is lighted during the daytime by 17 saw-tooth skylights through a ceiling of maze-glass panels. For artificial illumination, one arc lamp, equipped with a large reflector, is placed above each ceiling panel. The skylight tile work has been painted white with pleasing results. The effect has been to destroy shadows and color rings, to more evenly distribute the light and to make the color mellow and in harmony with that in the adjoining ticket lobby. All the light is directed downward and the annoying effects of flickering, wandering and feeding of the arc are greatly reduced. The illumination here averages about 1.8 candle-feet. It has proved sufficient for the work performed and easy on the eyes.

CONCOURSE.—The concourse occupies a space 755 ft. long by 150 ft. wide between the station building and train shed. It serves as a means of passage to and from the trains, and is lighted entirely by arc lamps suspended about 7 ft. from the ceiling. At this distance from the ceiling the lamps cast very slight shadows overhead. The absence of pronounced shadows is desirable on account of the paneling in the ceiling. It was attempted experimentally to light this space by placing arc lamps between the roof and ceiling over the skylights. The scheme was condemned principally on account of the steel work supporting the roof casting very pronounced shadows on the skylights, and because the glass used has a very large absorption factor and is not of uniform color when lighted artificially. Series direct-current arcs did not give good results on account of the great loss due to absorption. Flaming arcs, by reason of their great quantity of light, gave good results, but were abandoned because their pronounced yellow color was out of harmony with the general color of illumination in other parts of the station and because of the high cost and difficulty of maintenance in the positions they occupied. Fig. 6 is a view taken from the west end of the concourse. Other experiments were also made in an effort to reduce the total number of units used, by employing large diffusers containing four and five units each. This, however, gave the effect of large units of high intrinsic brilliancy and was for that reason abandoned. It also produced objectionable streaks and shadows on the ceiling. It is thought that this system would have worked out well had the ceiling been designed so as to have the diffusers set in it instead of below it.

With the arc-diffuser installation the floor illumination was sufficient, pleasant and uniform, but the streaks and shadows above, due to the non-conformity of the building design were considered quite objectionable here. The arrangement seen in Fig. 6 was finally adopted as giving good results with a reasonable cost of maintenance. Each lamp is equipped with a clear inner and an opal outer globe. The quality and distribution of the light is said to be as good as could be desired. Suitable casings to cover the wires and insulators directly above the lamps and canopies to improve the appearance at the ceiling outlets over that shown in Fig. 6 have been provided. A collapsible and movable extension ladder is used in trimming these lamps.

MISCELLANEOUS.—The dining and lunch rooms, womens' room, smoking-room, state apartments and porticos are lighted from ornamental bronze fixtures. These fixtures are in strict conformity with the decorations and architectural features of the rooms in which they are placed, but the irregularity of illumination is quite pronounced. Illumination curves show a variation, in the dining-room, of from 2.1 candle-feet under the fixtures to 0.7 candle-feet along the wall.

Incandescent lamps with reflectors have been placed in coves formed in the cornices of the main entrance to the state apartments of the vestibule. This cove lighting gives a satisfactory effect, but the installation is counted too small to furnish data of much value.

TRAIN SHED.—The train platforms are covered by umbrella sheds supported on cast-iron columns spaced 30 ft. apart along the center line of the platform. One large "Gem" lamp with a Holophane bowl reflector is suspended midway between each two columns, from an especially designed outlet box attached to the steel work of the roof. These are said to give sufficient light for loading or unloading trains and are readily accessible for renewals. The signs and numerals over the entrance gates in the [illegible] fence are illuminated by incandescent lamps controlled by push-button switches located in cabinets containing the numeral boards for the time signs.

With the exception of the few ornamental bronze fixtures, all the electrical work was designed and constructed under the direction of the Motive Power Department of the Pennsylvania R. R. Much credit has been assigned Mr. I. R. Prentiss and Mr. W. D'A. Ryan, of the General Electric Co., Schenectady, for the lighting in the important parts of the station.

NEEDED IMPROVEMENTS IN HOUSING CONDITIONS IN PITTSBURG, PA.

The Chamber of Commerce of Pittsburg, Pa., has recently taken on new life and broadened its activities so as to include a wide range of work for the betterment of the city in many specific lines. In the retiring presidential address of Mr. H. D. W. English, just published by the Chamber, we find some significant remarks on housing that apply with much force to other industrial cities and that deserve the thoughtful consideration of manufacturers generally. After reviewing the work of the Committee on Housing Conditions, Mr. English says:

> We do not wish to leave the subject of the proper housing conditions, affecting—as we believe it does—the commercial life of the city, without placing special emphasis upon its importance, if Pittsburg is to retain her proud position as the "Workshop of the World." A workshop as a commercial success means thousands of men who toil.
>
> Foundrymen tell the story of the manager who increased the output of a plant by having its windows washed and letting more light in. Is there not an analogy in this to the work of the committees on Housing, Sanitation and Smoke Abatement, through which this Chamber has endeavored to improve municipal conditions of living? Bad water, bad sewage, bad housing,

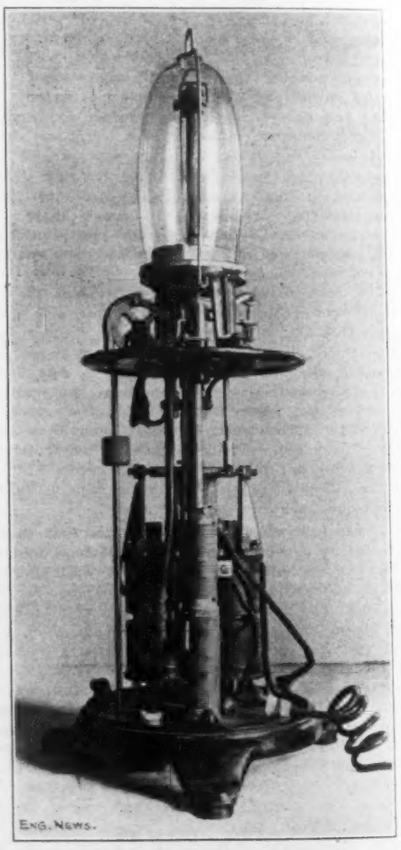


Fig. 4. Inverted Series Direct-Current Arc Lamp for Projector Units.

and bad air are a species of indirect taxation upon business interests, not only as taxpayers but in their effect upon output. We know, for instance, from the Health Bureau the number of deaths which are caused by typhoid and tuberculosis, but we have no measure of the cost entailed by these diseases in hospitals and alms houses and children's institutions, the inconveniences and losses to employers, which the irregularity caused by sickness means, nor the load which sickness puts upon the year's pay roll of these firms to carry their employees on sick leave. Much less have we information as to the lessened productive power of the men just out of hospitals or in a state of chronic invalidism. But we know that all of these things have some of their roots in bad water, bad sewage, bad housing, bad air, and that the movements to improve these conditions are turning so many deficits in the working force of the community into so many assets. We have the joint testimony of physicians, sanitarians, settlement workers and employment agents that the influence of healthful home conditions reaches inside of the factory gate. These are problems which the individual employer cannot work out for himself; so that it is eminently fitting that the Chamber should have taken the action it has during the past year to promote improvements in these conditions.

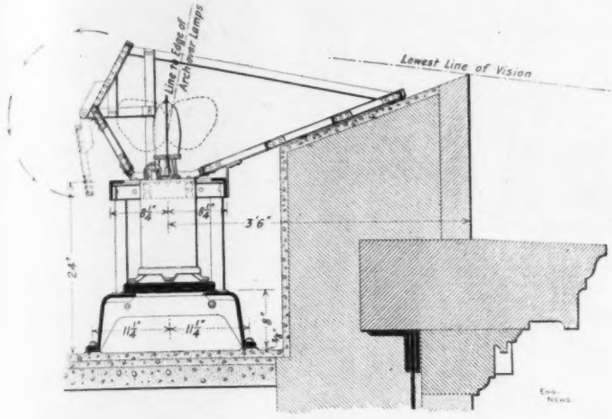


FIG. 5. SECTION THROUGH PROJECTOR UNIT USED IN WASHINGTON UNION STATION.

A firm establishing an industrial plant at a point removed from a large community has to face the problem of providing not only its mills, but housing accommodations for its employees. In a large city the matter of housing employers ordinarily takes care of itself. The city of Pittsburg, however, along with its vast industrial developments, has grown so phenomenally in population during the last ten years that it has been clearly impossible for the growth in housing accommodation to keep pace. Careful and comprehensive investigation shows conclusively that the housing facilities of the Greater City have completely broken down, not only in point of reasonably proper conditions, but in amount of available room space.

The simple truth is that until now Pittsburg has been so absorbingly occupied in keeping up with the insistent demand of the country and the world for its products that it has not had time to see to this matter. No mistake could be greater, however, than to think it is merely a question of philanthropy. It vitally concerns the business interests of every large concern in this city. It means a widespread reduction of efficiency in the labor force of the community. It means the serious hampering of the purchasing power of many thousand families on account of their being compelled to pay so much for meager housing accommodations.

It is quite clear that this need will not be met by the ordinary investor; he is not attracted by a 5 or 6% enterprise of this sort. While Pittsburg stands high among the cities of the country in the number of homes owned by her skilled and settled working people, the newcomers can only very gradually take their places among this class and by that time there will be other newcomers.

How far-reaching would be the advantage to the city industrially and commercially if some of our great corporations would undertake to provide an ample supply of comfortable dwellings to be rented by their own employees. The successful experience of the United States Steel Corporation with the sale of stock to its employees might suggest the adoption of the Berlin plan, by which a business concern organizes a housing company and sells stock to the workmen who are to live in the houses. This plan secures among working people who are unable or disinclined to become owners of their own homes many of the advantages of house-owning.

There is one phase of the housing problem which concerns very directly, not only the city of Pittsburg proper, but all the mill towns of the steel district. That is, the problem of suitable housing accommodations for the immigrant workmen who make up so large a share of the unskilled labor force. The night shifts and the necessity for calling out additional workers in time of emergencies make it important that these men should live near their work. The ground in the neighborhood of industrial plants in the city and the river valleys is comparatively small in area. It is often covered by old-time brick houses not built for multiple dwellings. Here the worst crowding exists in time of much work. Five, six, eight, ten and twelve men sleep in single rooms; and in some instances the beds which the night shift leave are taken by the day shift workers. Here toilet facilities, water, ventilation, are most often inadequate; here typhoid, tuberculosis and other diseases are most common; here the municipal authorities find it most difficult to build up health standards, as there is apparently no place else for these men to live; and here the conditions are such as to be absolutely inimical to the development and health of such children as live in these districts. Several factors enter into the situation which mark it off from the general problem of housing—questions of investment, available land area, the lodging or boarding boss system, the transient character of population; and the different standards of living, often those of an outdoor peasant people which these men bring with them. The problem may well offer an opportunity for leadership on the part of the Pittsburg Chamber in undertaking through its Housing Conditions Committee such a study as may lead to some original and satisfactory solution. The committee in the future should take up the proper housing of the largely increasing immigrant labor force of this city and help to solve this problem, which involves the future of our city industrially.

"BREAKDOWN SERVICE" IN NEW YORK CITY: THE EMERGENCY SUPPLY OF ELECTRIC POWER TO OWNERS OF PRIVATE PLANTS.

"Breakdown service" or the supply of electric power to isolated private plants in time of emergency has been resumed by the New York Edison Co., in New York City, as the result of the efforts of the Public Service Commission for the First District. Such service prior to 1905 was supplied to all applicants at yearly rates varying from $10 per KW. of installation of power-using devices to $30 per KW. of maximum demand. In 1905, when the New York Legislature fixed the maximum price of electric power in Manhattan at 10c. per KW.-hr. this breakdown service was discontinued. The efforts made to have the Edison Co. restore such service are recounted in the recent report of Commissioner Milo R. Maltbie. It is interesting to quote one passage of the report.

It has been claimed also that it is not fair, even if practically possible, to ask the supply companies to furnish current to private plants, their competitors, when it becomes disadvantageous for these competitors to supply it themselves, any more than it would be fair to permit one express company to take the more profitable business and to compel a competitor to do that portion of its business which was conducted at a loss. The analogy is not sound and the argument is fallacious. The requirement that breakdown service be supplied does not imply that one supply company shall provide current for another company at less than a fair price. Further, the private electric plants are not competitors for they do not distribute current beyond their own premises. They cannot combine their plants and thus be of mutual assistance in case of disability for, by so doing, they would be compelled to use the streets for their wires and to do so would require a franchise and subject them to public regulation and control. It is not considered proper for a railroad company to refuse to carry a passenger during stormy weather merely because he uses his automobile or walks during fair weather or when he wishes to go only a short distance; neither does it seem fair for an electric supply company, which is also quasi-public, to refuse to supply an individual merely because he produces a portion of the current which he consumes. The electric companies have been given the use of public property; their wires are in the streets; they have many rights and privileges which the ordinary individual does not possess. It seems but fair, therefore, that they should also undertake to perform the obligations which go with these privileges, and one of these fundamental duties is to supply current to every one who desires it and who pays a fair price.

It should not be assumed that breakdown service or any special kind of service must of necessity be supplied at the same rate at which other service of a different character and of a different cost is supplied. It may be that such special service as we are now considering should be supplied at a different rate from that charged for current under ordinary circumstances; but, assuming that the rate is fair, that a reasonable profit is allowed to the company thereon, it is, in my opinion, the duty of the supply companies to provide breakdown service under ordinary circumstances.

After much discussion the Edison Co. submitted a plan by which they proposed to supply the desired service at a minimum rate of $30 per KW. of installation of power-using devices. In the succeeding conferences, with the prospective users of such service, it was generally claimed that such a rate was prohibitive, as

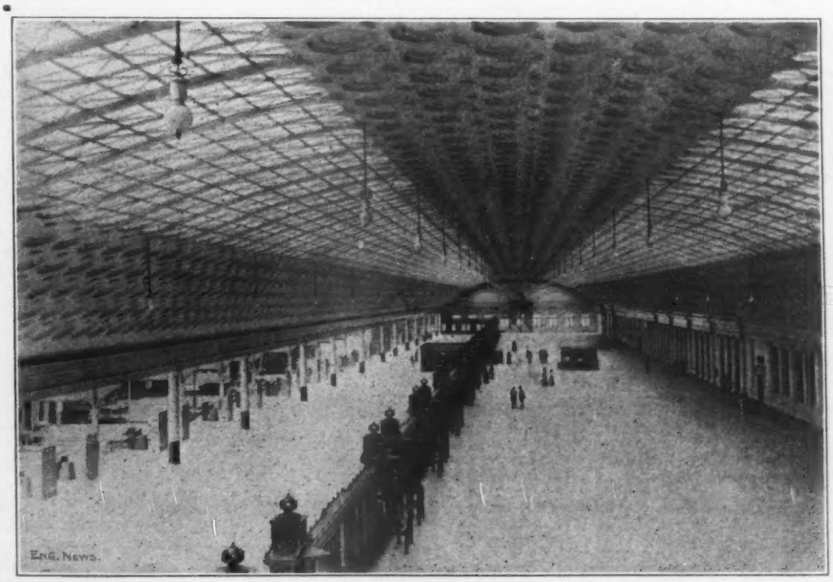


FIG. 6. VIEW OF CONCOURSE, WASHINGTON UNION STATION.

only 30 to 60% of the total installation in a building was in use at any one time and that any charge based on total installation and not on maximum demand would generally be unjust. The Edison Co., on the other hand, maintained that experience had shown their plan to be just. However, data were not available to support either side of the contention.

Finally a tentative proposal was made by the company on a basis of a guarantee of $30 per KW. per year, maximum demand. The supply connection is to be made through a special limit switch so that no more than the guaranteed maximum demand can be drawn. Data for future readjustment of the charges will be furnished by recording instruments attached to each breakdown connection. The concessions obtained are summarized in Mr. Maltbie's report as follows:

(1) Breakdown service will be furnished to any owner of a private plant who applies for it.
(2) The use of current need not be restricted to certain hours or certain purposes; it may be taken at any time and for any purpose, thereby obtaining not only pure breakdown service, but auxiliary service as well.
(3) The consumer may specify the maximum amount of current to be taken at any one moment regardless of his installation.
(4) The guarantee will be computed not upon installation but upon maximum demand.
(5) The company will place recording devices on every breakdown connection and take the records under the supervision of the Commission for the purpose of determining a fair charge for service to be fixed in the future.

THE FOOTPATHS OF THE MANHATTAN BRIDGE.

The two photographs accompanying this article are very interesting as records of the progress of work on the latest suspension bridge* connecting Manhattan and Long Island across the East River and as illustrations of the methods of construction on so large a structure. In our issue of June 18, 1908, p. 678, we noted the start of the stringing of the cables which form the basis of the swinging paths shown in the halftones. This work was started June 15 and finished five days later. On July 7, the construction of the footpaths was commenced and it was finished on July 13, on which day the first man crossed from one side of the river to the other.

In the photographs, the two views are toward the Manhattan side of the river, one on either side of the tower pier. The nature of the construction will be readily understood. First, four groups of four cables each were strung in approximately the same location as the future main cables will hang. Upon these cables as a track, traveling cages were let down, from which were laid the timber floor beams clamped to the cables in pairs so as to form two systems of paths. Upon these floor beams the stringers and floor were spiked. Work is now going on upon the system of storm bracing (not shown in the views), upon the completion of which the weaving of the main cables will be started.

The immense cost of land damages for the approaches may be appreciated after an inspection of Fig. 1, which shows the very thickly built section into which the Manhattan end of the bridge penetrates.

*For previous description of the Manhattan Bridge see Engineering News, Aug. 3, 1905, p. 107; April 16, 1908, p. 418.

FIG. 1. VIEW FROM MANHATTAN TOWER OF MANHATTAN BRIDGE, LOOKING TOWARD ANCHOR PIER. TAKEN JULY 18, 1908.

FIG. 2. VIEW FROM MIDDLE OF MANHATTAN BRIDGE, LOOKING TOWARD MANHATTAN TOWER. TAKEN JULY 18, 1908.

THREE MINES IN GOLDFIELD, NEVADA, have produced gold of a total value of over $38,000,000 in the five years since working began, says Mr. T. A. Rickard in the "Mining and Scientific Press" of July 11; yet "out of this lordly sum, only a driblet of $4,370,000 has reached the shareholders." Mr. Rickard calls this disgraceful and contrasts the record with the Cobalt district where from a total production of $6,000,000 per annum over 60% has come into the mine owners' pockets as profit. Answering the question where the huge revenues of the Goldfield mines went to, Mr. Rickard refers to the fortunes made by lessees operating under royalties and to the carnival of theft described by him in our issue of June 25, p. 698. Taking the Goldfield Consolidated group as an example, he says it produced fully $6,250,000 gross in 1907, and out of this the shareholders have had two 10-ct. dividends, making $710,000, although the profits to the company were $1,760,358. The lessees made about $2,000,000 and the miners stole fully $1,000,000. Evidently all is not gold that glitters—in mining shares even when the mine is a bonanza. A large part of the profits of the field has also been absorbed by the railways and smelters in charges for ore carriage and treatment at rates which Mr. Rickard says "were in effect, legalized robbery."

NON-SPINNING HOISTING ROPES are very desirable in hoisting heavy loads, but ordinary ropes will rotate or spin when such loads are attached. This is not only troublesome, but may be dangerous, and necessitates the use of guides to hold the load in position. Various forms of non-spinning ropes have been patented, and one of the latest patents (No. 883,759, April 7, 1908) has been issued to Mr. Olof Tangring, an engineer with the American Steel & Wire Co. It is stated that at a marble quarry in Vermont a cable made under this patent raised a block of stone 250 ft. without the load making half a turn during its ascent. No guide line was used. The construction of the rope is described as follows by the manufacturers:

An inner series of wire strands is wound in one direction over a core, and an outer series of wire strands is wound about the inner series as a core in the opposite direction. The wires which make up each of the individual inner strands are twisted in the same direction as the lay of the strands; but in the outer strands the individual wires are laid in opposite direction to the lay of the strands.

The number of strands required for the second or outer layer must of course be greater than the number of strands in the inner layer. For this reason, the inner layer has the wires as well as the strands all laid in one direction as described, thereby giving them a tendency to untwist very much faster than if they were twisted in the opposite direction to the lay of the strands. The wires in the outer layer, being laid in an opposite direction to the lay of the strands, do not tend to untwist as fast as in the inner layer. The strands in the outer layer, however, counteract the tendency of untwisting of the rope as a whole.

When a weight is applied to the end of the rope, the greater number of strands of the outer layer have a tendency to untwist in one direction, whereas the fewer strands of the inner layer have a tendency to untwist very much faster in the opposite direction, and it is found in practice that these two actions almost perfectly balance each other.

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In our issue of Aug. 29, 1907, we published several extracts from a lecture by Prof. V. B. Lewes, of the Royal Naval College, Greenwich, and Chief Gas Examiner to the City of London. In this lecture it was claimed that a gas-lighted room would be more pleasant and healthier to live in than one lighted by electric incandescent lamps. From an engineering viewpoint this paper was spoiled by inserting seemingly impossible and apparently ludicrous statements. Indeed it served rather to arouse ridicule than to stimulate study—at least on this side of the Atlantic.

The paper of Dr. Samuel Rideal, the well-known English sanitarian and author, abstracted in another part of this issue, should meet with a kinder reception because of the thorough and scientific way in which a mass of small details have been handled. The statements presented are far more conservative and reserved than were those of Professor Lewes, and are based on an infinitely more complete study.

On more that 50 occasions 15 healthy men were subjected to some 6,000 tests of various kinds to detect depreciation in their physical conditions under gas and electric lighting. The results of these tests do not show an appreciable difference in the effects of the two methods of lighting nor do they show any changes in any part of the body from a state of normal activity. The very slight differences noted between the effects of the two systems are utterly without hygienic significance, and were no greater than would have been produced in normal men by slight changes in bodily conditions and in environment, other than the lighting.

Many interesting conclusions may be drawn from Dr. Rideal's paper, some of which are worth a passing notice here. While burning illuminating gas consumes oxygen and produces considerable amounts of carbon dioxide, water vapor and other undesirable products, and while with incandescent gas burners about twice as much heat is liberated for a given illumination as with electric lamps, nevertheless the atmosphere in a room with restricted ventilation has shown nearly the same composition and the same temperature under one system as under the other. When several persons are in a single room, unless it be of comparatively very large proportions, the temperature and the conditions of the air are more affected by the occupants themselves than by the illuminant—whether it be gas or electric.

The supposed un-hygienic effects of gas illumination have been used for years as a strong argument by the interested advocates of electric lighting. It now remains to be seen how these interests will receive the blunting of one of their favorite weapons of attack.

There are a few points in Dr. Rideal's studies that are incomplete or not entirely convincing. Additional information on these points might well be sought to completely establish his case. For instance, it will be noted that these studies were made in cold weather, that the excellence of gas lighting is due to increased ventilation, and that this in turn is due to a greater temperature difference between exterior and interior air. It would naturally follow, then, that some of the redeeming effects of gas lighting might be largely lost in summer time when the temperature difference would be largely decreased.

As long as Dr. Rideal's studies were made in a steel framed structure it would seem that the heat liberated, one of the two chief factors affecting the health of the occupants, was conducted away much faster than in a house of timber construction, so that his conclusions are not completely satisfying. Would the increased ventilation in the lighter construction compensate for the decreased temperature difference? That can be shown only by experiment.

This study is a comparison of the incandescent gas and electric lamps, and the conclusions do not apply to gas lighting by open flames with their poorer and smaller light-giving qualities and with their incomplete combustion at times.

In a paper on waterproofing, read before the American Society of Civil Engineers (Engineering News, Sept. 26, 1907, p. 344), Mr. R. H. Gaines, Chemist of the New York Board of Water Supply, said:

> The statement is made by one well-known authority on cement and concrete that additions of from 5 to 10% of hydrate of lime, replacing such proportions of cement at the time of mixing the mortar, will produce practical impermeability. This, however, is not in accord with our experience. Our experiments indicate that, while slaked lime slightly decreases the permeability, this advantage is more than offset by the decrease in the strength of the mortar. There is no chemical reason why other results should be expected.

As this statement has had considerable publicity it seems strange that a concern manufacturing hydrated lime did not have included in the tests to prove the waterproofing efficiency of its product—carried on by Mr. S. E. Thompson, and republished on another page of this issue—a determination of the effect of the included hydrated lime on the strength and, if possible by accelerated tests, on the wearing qualities of the concrete. It is probable that Mr. Thompson is the "well-known authority" mentioned by Mr. Gaines, in which case his contention as to practical impermeability is established by these latest experiments, but in order to settle this question of strength, which is equally important as watertightness, he surely should have made a further extension of his studies.

The concrete-block industry seems to be gradually freeing itself from the dominance of what has hitherto been a vital factor, excellence and uniformity of face. The field in which the industry has made its chief advance is one which does not depend on face finish, and at the same time gives fullest advantage to the special merits of the concrete block. Plain wall work constitutes this field. It is a healthy symptom, we believe, that commercial developments have tended to restrict concrete blocks to simple wall construction and abandon most of the early pretences to far-reaching architectural utilization.

The concrete block as a building material is simple and cheap so long as the demands as to face finish remain moderate; but when these demands are extended to the necessary degree to make the block available for a general architectural purpose, it becomes a high-priced, troublesome material. Face finish and ready variety of form are essential requisites from the architectural, i. e., ornamental, viewpoint, and they are just the features in which the concrete block is weak.

For purposes where appearance counts, therefore, the block is badly handicapped. Yet all the early development of the industry was directed toward overcoming this handicap. Now, however, this effort has largely been allowed to die a quiet death. In its stead the effort is to strengthen the strong points of the concrete block: to make it more readily available everywhere irrespective of local facilities; to make it cheaper, and more adapted to untrained labor; to improve its insulating qualities; to simplify the work of laying up walls. This is a proper effort, one which, recognizing the peculiar sphere of the new material, aims to develop its full possibilities within that sphere.

The importance of one feature of the concrete block receives less than its due recognition, we believe. This is the large size of the unit. Brick is restricted to a small size of unit by the fixed requirements of the process of making. It has a small bed area, and therefore requires skilled labor to secure regular, substantial laying; even so, the thinnest walls that are built take the width of two brick for reasonable security of bearing. It is so thin that five bed points come within but one foot of height—five elements of weakness, initial settlement and subsequent disintegration. It is so small in face that 16 or 18 bricks must be handled to build up a square foot of face of the thinnest wall. The concrete block, on the other hand, makes it possible to employ very much larger units, as large as can be handled, in fact; and thereby it avoids each of the disadvantages mentioned. The gain is obvious, though it may not be easy to calculate in figures. It is a highly important factor of the popularity which the concrete block has won.

According to recent dispatches from Washington, D. C., we are to have, in the case of the apartment house which failed in that city last month, another attempt to convict owner and contractor for negligent building construction. With increasing frequency have we seen coroner's juries bring in charges of neglect in such cases and grand juries indictments for criminal negligence, but rarely—never in our best recollection—have we heard of conviction in the trials that followed such indictments. A verdict of guilty at Washington, then, will be an exception which will not help greatly toward a more general regard of the rules of safe construction.

The charge of criminal negligence is notably hard of proof, particularly when the accused is engaged in some profession or trade where expert evidence is required to define the exact state of the art, and where the amount of care and knowledge necessary for a safe construction is not easily to be ascertained to the satisfaction of a court of law. As an immediate example, the concrete contractor under indictment in Washington is now awaiting a second trial under a similar charge for what appears to be much more flagrant negligence in a Philadelphia building. With the evidence most seriously against him, the first jury could not come to an agreement, principally on account of the legal difficulties involved in evidence necessary for conviction on the charge of criminal negligence.

The conviction of an owner is even more problematical. In this particular instance the conditions are well outlined in a hypothetical case presented in an editorial published in our columns about a year ago. This paragraph referred to no particular construction, but was instanced merely as an example of a certain type of construction prevalent in New York and our larger cities. It read as follows:

> A real estate man owning a building plot wants to put up a building of maximum profit-capacity at minimum cost. He seeks out an architect, explains his wishes, and bargains for the purchase of a set of plans suiting his purpose, the plans to be guaranteed to pass the building

department. The price of the plans is forced down as low as the architect's business conscience will permit . . . After the owner has the plans and the building permit, he constitutes himself a General Contractor, for the purpose of erecting his building without paying for competent supervision; the architect has already disappeared from the scene. Sub-contractors for the foundation excavation, the masonry, the steelwork, the fireproofing (if there be any), etc., are secured at the lowest lump-sum prices that can be bargained for. Work then proceeds, according to the approved plans, under the owner's supervision (or that of his clerk), as badly or as well as the sub-contractors' several consciences dictate; from time to time an inspector of the city building department visits the job to see that the masonry does not lag too far behind the steel, that the approved plans are being followed and the like. There is no other eye than his to watch over the construction work, no conscience but his to enforce the law's demands.

But admitting that the procedure has been as indicated, is it possible to convict the owner for negligence? Arguing from past trials, we would say no. The owner can always claim that so far as he knew the subcontractors were equally as competent to build safely as any superintendent he could employ and, although unfortunate in his selection, he was not criminal. Under the law as at present codified in most of our cities and with juries as usually constituted his contention will be upheld.

So we are forced to return to a plea that has been made time and again in these columns, a plea for better building laws; for laws that will fix the responsibility for preventable accidents, that will establish some qualified set of men, whose authority to build comes from the government and who can be held responsible for their failures outside of the common law. The suggestion of the grand jury, as noted on another page of this issue, that the building department shou'd be given more power, will not answer the requirements because we have not become so paternal a government that we can afford immediately to supervise all construction. Such laws have not been passed nor can they be formulated without due study and conference, but the coming trial at Washington, viewed in the light of similar trials in the past, is a fitting and timely text for a sermon upon the inadequacy of the present system.

We call especial attention to the letter of Mr. Gustav Lindenthal, on another page of this issue, suggesting a very simple and cheap plan for making tests of the largest-size compression members of great bridges. Mr. Lindenthal gives due credit to the St. Louis Bridge engineers of the early '70's for the suggestion. It happens that immediately following the Quebec Bridge disaster this same plan for the making of compression tests was suggested and discussed among the editorial staff of Engineering News, and we have as yet been able to see no reason why the plan is not entirely feasible and practical, and in fact the very best way to make compression tests on members of huge size. Of course a proper location should be chosen and the slot in the rock should be deep enough so that a wedge could not shear out to the surface. All this means nothing more than the exercise of sound engineering and common sense.

As our readers know, the Blackwell's Island bridge has fallen under more or less public suspicion because of its similarity in design, both in form and details, to the ill-fated structure at Quebec. We have not joined in the attacks on the structure, for we have no desire to arouse public alarm, and appreciate the fact that public nervousness regarding a great structure is more difficult to allay than to arouse and may have most serious results—witness the fatal panic that followed hard on the opening of the Brooklyn Bridge, nearly a quarter century ago.

On the other hand, it has not seemed to us proper to take the course adopted by a contemporary and adorn the structure with a coat of whitewash. *We want first to know more regarding that structure than any one now knows* before we shall join in the chorus that

> "You are right
> And I am right
> And he is right as right can be."

What is wanted concerning the Blackwell's Island bridge is not expert opinions, but *facts*. We said emphatically, in commenting on the Quebec Bridge disaster, that actual tests of largest-size columns must be made before the engineering profession could have full confidence in the stability and safety of its greatest structures. We hold the same position to-day. *The Blackwell's Island bridge must not be opened for public use until the strength of its great compression members has been proved by actual test.*

One of the most serious of the many difficult problems of the modern city is how to secure decent and healthful house room for people of small incomes, and particularly those whose incomes are both very small and very irregular. The problem is generally considered, when considered at all, as related only to the health, and perhaps the morals, of the wage-earners and their dependents, but in reality it vitally affects the health, the morals *and the industrial welfare* of the whole community, and reacts from the community upon the country at large. Elsewhere in this issue we reprint remarks by President English, of the Pittsburg Chamber of Commerce, which exhibit some of the many important phases of this subject. The remarks deserve wide attention.

FLYING MACHINES FOR WARFARE.

Press dispatches from Washington state that army officials there are worried over the progress in aerial navigation that foreign governments are making. They think their worry would be calmed if Congress would appropriate $10,000,000 at its next session for the construction of military balloons.

It is easy to worry in hot summer weather and the July temperature at Washington, D. C., may be conducive to worriment. However, the newspapers, in these days when the Presidential campaign has only begun to simmer, are devoting their spare space to the exploits of the flying machine inventors.

These exploits are admittedly well worth recording. They represent a very high order of mechanical achievement. The men engaged in them are, many of them, men of prominence in the industrial, scientific and financial world. Mankind has for centuries longed to be able to fly. It now looks as if the mechanic arts had about reached a stage where flying would be practicable for the man willing to pay the price in money and incur the risk.

But the point which the engineer can see, and which the lay mind, we fear, is often unable to see, is that aerial navigation is, from the very nature of the case, bound to be costly, both in money and in risk to life and limb. These facts will not deter it from sporting use. In fact the danger will rather increase the attraction.

It may seem strange to some that inventors and engineers should spend great sums of money in the development of machines for flying, but the amusement interest is more important financially than is often realized.

We recall an engineer who won a reputation and made a fair living in the structural field. He utilized his knowledge of structural engineering in an amusement enterprise and won riches, almost without effort, such as he would never have been able to gain in the strict lines of professional practice. To be sure his sudden fortune turned his head and ruined him—which fact may also contain a lesson.

There is something in the flying machine business, therefore, in the way of prospective financial returns, notwithstanding the fact—which engineers at least, understand—that the flying machine could not possibly compete with the railway or automobile for freight or passenger traffic. It is quite within expectation that a few years hence experts in gliding flight will earn a lucrative salary as attractions at county fairs, and the dirigible balloon will be the chief sensation at larger amusement resorts.

It is quite within expectation too, that that not inconsiderable class in modern society which has been by cruel fate deprived of the necessity of working for a living and which spends its time seeking new sensations will take up aerial navigation as a fad. Indeed, this has already come to pass in France; and as that country sets the fashion in sports as well as clothes, we may look forward to seeing the heads of millionaires flying over our heads in dirigibles instead of flying past our doors in automobiles.

And now what is there besides this in the flying machine? Has it really any possible military value? Is there any real justification from the military point of view for flight through the air?

As our readers will recall, trial flights of the competitors under the Government call for flying machines are to be held at Fort Myer, Va., beginning Aug. 28. The question arises whether these experiments are to be regarded as the forerunner of an important advance in the art of warfare or are merely an interesting diversion of army officers, who in time of peace are glad to have something to study and experiment upon, involving some features of novelty and popular interest.

Of course in the popular mind the idea is firmly fixed that the successful flying machine would be an important weapon of warfare. Sensational writers endowed with powerful imaginations have painted the pictures of the airship hovering at a great height over a doomed battleship and dropping a charge of high-power explosive in the precise spot where it would blow the vessel below to atoms. They have foreseen armies in the field wiped out in the twinkling of an eye by bombs dropped from the skies by airships overhead.

Of course these pictures are based upon the idea of airships that could sail around and do business in all sorts of weather; and it is a very, very far cry from the present day airships to such vessels. Suppose, however, that airships were eventually developed which could stand a fair amount of storm and could navigate with some reasonable probability of going where they desired. Would such vessels be of any conspicuous military usefulness? We confess that so far we are unable to see it.

The point which seems to have been largely overlooked by the enthusiasts over military ballooning is that the enemy is armed with dangerous weapons, and has every opportunity to use them on his aerial foe. In fact all the advantage lies with the man on the ground compared with the one in the balloon.

It must certainly be conceded that the successful airship must be of large size, whether it be of the dirigible balloon type or of the heavier-than-air type. Count Zeppelin's huge dirigible, which carries 14 men, is over 400 ft. in length. The aeroplanes and helicopters and other devices by which men hope to lift themselves into the air without the use of a gas bag are necessarily both huge and fragile.

The military airship, carrying explosives and weapons of offense, would necessarily be still more bulky in order to lift the necessary weight. One can imagine the delight which the sharpshooters of an army would take in firing at such a huge mark as soon as it appeared in sight. If there is any question as to the present-day long range military rifle being able to put a flying machine or its operators hors de combat at a distance of two miles or more, it would be an easy matter to adapt a light artillery piece to send a hail storm of bullets straight at an aerial foe at perhaps double this distance.

It seems to us, therefore, that the military airship of imagination, dropping down bombs and explosives from the skies upon a foe is an absurdity. If you are anxious to shoot another man, a balloon is about the poorest place in the world from which to do it, because it gives all the advantage to the man on the ground. Two aeronauts who ascended from Massachusetts a few weeks ago reported that their balloon was fired at and hit while they were passing over New England. The men in the balloon were unable to see who fired the shots. A thousand men could be readily concealed in woods or buildings where they would have perfect opportunity to see and

fire at the balloon and yet be undiscoverable from it.

Even if an airship could steal a march on an army or a fleet and sail straight over their heads before discovery, the damage it would be possible to effect by dropping any such amount of explosive as could be raised in the air on a flying machine would not be great. High explosives have a small radius of action. Talk about annihilating an army or destroying a fleet by such means is absurd.

It is said, however, that while the airship may not carry weapons of offense, it may be a valuable auxiliary to an army's signal operations. Inasmuch as the coming tests at Fort Myer are to be conducted by the army signal service, it appears to be this function that the army officers have in mind.

Our esteemed contemporary, the "Scientific American," waxes enthusiastic over this and declares that "if the airship can only fulfil its present promise, the time is not far distant when the art of war as practised to-day will be stripped of its most important element of success and its prosecution, at least along modern lines, will be rendered well-nigh impossible." Its reasoning is that strategy, or deceiving an enemy as to the movement and disposition of one's own forces, will be rendered impossible because of the information gained by military scout airships.

We shall freely admit that there is what might be called "a fighting chance" that the observer from an airship might have a somewhat better chance than the observer from a captive balloon. But this is not saying much. We must remember that the captive balloon was quite useful for observing an enemy's forces in the old days when black powder and short ranges made one safe from an enemy's shots at a distance of a mile or so. When a captive balloon was sent up by the American forces in the Santiago campaign, however, its chief result was to attract a fusillade of shots from the Spanish side, which did execution among the Americans far back of the point where the balloon was sent up.

Thus the increase in range and accuracy of modern weapons has made it necessary to use observation balloons or flying machines at a much more respectful distance from the enemy's forces than was formerly the case.

The observation balloon or flying machine which is studying—or attempting to study—an enemy's forces, therefore, must keep several miles away from his picket outposts. How much valuable knowledge of an enemy's forces will it be possible to gain from a balloon distant perhaps four to seven miles from the enemy's headquarters? Engineers who are familiar with the work of topographic reconnoisance know very well that in broken country observations at any such distance are extremely deceiving. Only a comparatively small part of the surface, in a region of hills and valleys, is visible to the observer from a high mountain top. An occasional clear day, it is true, enables a good view to be had at a long distance, but in hazy or cloudy weather, details are indistinguishable at a mile or so.

To sum up, therefore, it seems to us that the military flying machine designed to obtain information of an enemy's movements, will be kept so far away by the danger from the enemy's projectiles that it will be practically unable to see enough of the enemy's movements to make it in any respect worth while.

LETTERS TO THE EDITOR.

Should the Railways Operate Their Own Tie-Preserving Plants or Have the Work Done by Contract?

Sir: Referring to the article written by Mr. S. M. Rowe in your issue of July 2, entitled "Proper Methods of Treating Timber":

The Wellhouse process for the treating of timber is being gradually dropped for the reason that the extra cost is not justified by the increased life of the material treated. Creosote oil is fast becoming recognized as the only efficient preservative for timber treatment. It is true that zinc chloride, in some localities, has been fairly successful, but to take it as a whole it cannot be considered so.

I wish to draw special attention to Mr. Rowe's remarks near the close of his article, wherein he states that railways should be advised to build and operate their own plants, and to be able in this way to fully control their operations.

For many years I did timber treating work for one of the largest railway systems in the United States, and naturally I would not criticize their methods of treating, or the manner in which they operate their plants. I can say, however, that leading railway companies who have treating done by commercial plants, are most rigid in their specifications, requiring all material to be brought up to the standard of perfection before it will be accepted; but in their own plants they cannot see the necessity of employing thoroughly competent and experienced men for operating, for the reason that they are not willing to pay the salaries that competent men command. The result is that many railway companies are building large and expensive wood-preserving plants and placing men in charge of them who know absolutely nothing about the principles of wood preservation. The consequence is that they are merely training up men, who, by the time that they are in position to be of value to their own company, are seized by large commercial concerns, who recognize the necessity of having experienced and competent men to operate their plants, in order to fulfill the specifications in connection with the treatment of railway and government material.

The result is that the railway companies waste hundreds of thousands of dollars in the operation of their plants by having inexperienced and incompetent men to handle their work for them.

Why then advise railway companies to build and operate their own plants, when large commercial concerns have been organized, combining experience and capital, for the successful operation of their plants?

By having men in charge who have had years of experience, most of them having been trained up with railroad companies and who fully understand the requirements for treating timber, it stands to reason that large commercial concerns can treat material much cheaper, and get out a far superior product as a result of continuous operation.

Yours truly, F. D. Beal.

Eagle Harbor, Washington, July 10, 1908.

A Ready Means of Making Compression Tests on Large Size Compression Members with Special Reference to the Blackwell's Island Bridge.

Sir: In the recent discussion of compression tests so much needed for various forms of steel-columns, it has been assumed that for members of large diameter or section a very large and costly machine is needed.

I wish to call attention to a method of testing large columns to destruction proposed in 1872, by that truly eminent engineer, the late Col. Henry Flad (past-president of the American Society of Civil Engineers), for the St. Louis steel arch bridge.

Col. Flad proposed to erect a testing plant as illustrated in Fig. 1 (taken from page 118 of Prof. Woodward's History of St. Louis Bridge).

With a hydrostatic pressure upon the plunger of 8,000 to 10,000 lbs. per sq. in., a total of 12,800,000 lbs. could have been obtained; more than sufficient to crush one of the steel tubes used in the St. Louis bridge. The testing of three tubes would have cost $4,000.

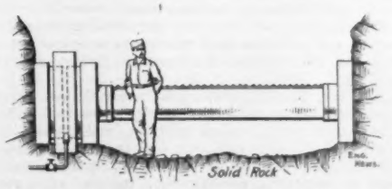


Fig. 1. A Proposed Method of Testing Large Steel Columns.
(From Woodward's "History of the St. Louis Bridge.")

His method could be readily applied, and at small expense, to the large compression members of the Quebec and Blackwell's Island bridges, and to those of larger bridges yet to be built.

A quarry of solid stone and a few large machined steel castings accurately mounted would complete a testing plant at a cost of about $9,000 and capable of exerting a pressure of 50,000,000 lbs.

The largest compression chord members in both the named bridges would probably fail long before half of that pressure is reached.

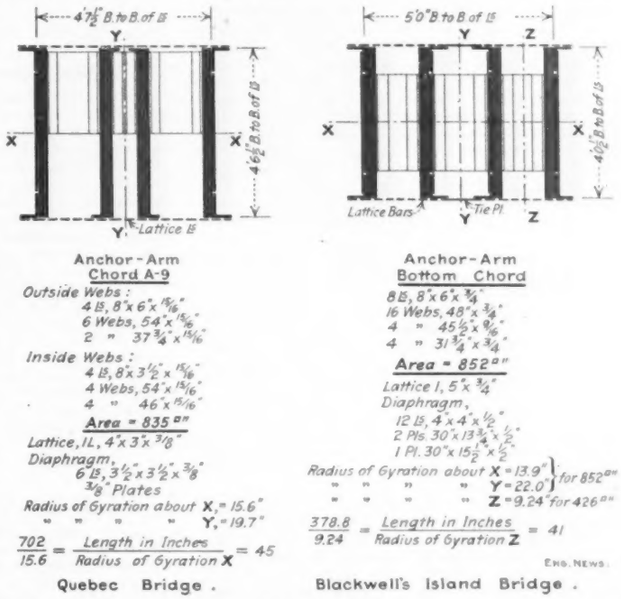


FIG. 2. TYPICAL BOTTOM CHORD MEMBERS OF THE QUEBEC BRIDGE AND THE BLACKWELL'S ISLAND BRIDGE.

A model of the Quebec chord section failed under an estimated pressure of 18,000 lbs. per sq. in. I say "estimated" because the testing machine on which the model was tested required correction for large frictional resistances, which themselves are unknown and were only estimated.

A model of a chord of that form is costly and probably not much if any cheaper than the full-sized member. It permits only inferences and deductions as to strength, but cannot furnish the accurate information which a full-size test would furnish.

This matter is of especial importance for the Blackwell's Island bridge in this city, for which a new strain sheet on the basis of the now accurately known dead load is said to be in preparation. The strains from dead load in that structure are statically determinate and therefore readily obtained. The strains from live load are very much smaller and statically indeterminate, but have been computed accurately before and only require adaptation and checking, which should have been done by the Bridge department long ago. It should have been done, when the dead load was increased and before the amended plans were approved. The completed strain sheet will, however, be of little value for judging the strength of the bridge, unless the strength of the compression members, and especially of the bottom chord, is known. At present it is totally unknown. No one can now tell with any degree of certainty whether buckling will take place with 18,000 or 27,000 lbs. per sq. in.

The city is said to have appropriated $30,000 for the purpose of ascertaining the carrying capacity of that bridge, a sufficient sum (unless used up in unnecessary fees) to make full-sized tests with two or three bottom chord members, and to make this most valuable contribution to our knowledge of compressional strength.

An inspection of the two chord sections shown in Fig. 2, one from the Quebec bridge and one from the Blackwell's Island bridge, leaves no choice of merit between them. The absurdity of relying upon any kind of compression formula for judging the strength of a column in which the mass of the section is composed of stitch-riveted thin plates, has been abundantly proven by the collapse of the Quebec bridge. In the absence of real tests with them, no engineer's opinion on the strength of a bridge, having such compression members, can have any value.

Gustav Lindenthal.

45 Cedar St., New York City, July 17, 1908.

The Mineral Wealth of the Wisconsin-Illinois-Iowa Lead and Zinc Mining District.

Sir: In the corners of three states, Wisconsin, Iowa and Illinois, is a tract of mineral land little known outside of its immediate neighborhood. This tract is in the counties of Grant, La Fayette and Iowa in Wisconsin, Jo Daviess County in Illinois and Dubuque County in Iowa, an area of about 3,500 square miles.

This tract is covered with a deep, rich soil and produces abundant crops. Underlying this rich agricultural surface is a wealth of minerals running hundreds of feet in depth.

There are four cities in the district, namely, Dubuque, Iowa; Galena, Ill., and Platteville and Mineral Point, Wis. Of these the most notable is Dubuque, which is a prosperous city of nearly 50,000 inhabitants. The other three have populations varying from 5,000 to 7,000 and are growing rapidly. The other principal mining centers are Cuba City, Benton, Hazel Green, Shullsburg, Dodgeville, Livingston, Potosi, Linden, Mifflin and Highland. These are all thriving towns, equipped with water power, electric light, and telephone service. They each have fair railroad facilites, and the field is now ripe for electric interurban railways and centrally located power plants to furnish electric power to mines, mills and factories.

The ores mined are lead (lead sulphide or galena) zinc (zinc sulphide and zinc carbonate), copper, sulphur and iron. These ores form in fissures, flats and pitches, and there are large bodies disseminated in the rock. Large bodies of lead are also found in boulder formation, in pieces ranging from 50 to 1,500 lbs. in weight. There are bodies of copper ore in the district which can be operated with profit, the Indians before the advent of the white men having smelted large quantities of it, and the ruins of their furnaces are yet to be seen at many places in the district.

Large deposits of pure sulphur are to be found at various places in the district, notably at Linden, where it is being profitably mined.

The ores are found at shallow depths, 80 ft. in some localities and 100 ft. in others, and there are still others in which they occur from the grass roots. The method of mining is simple and comparatively inexpensive, no more than $50,000 to $60,000 being required to prospect, develop and equip these mines with concentrating mills and machinery, and to bring the plant to a point of successful operation. The average time required to develop these mines to this point of productiveness varies from 9 to 15 months. Some 400 mines in the district have been developed or are in a process of development. Of this number 105 have been equipped with concentrating mills within the past three years, a majority of them during the last 18 months. There are now 50 additional mills contracted for this year.

Eight years ago there was but one small mill in the entire district and that was on the Raisbeck mine at Cuba City. It will be seen by this that the district is in its infancy. The zinc output for the year 1907 was $3,500,000. Upwards of $50,000,000 of lead and zinc, principally lead, had been recovered in the district prior to 1905. This recovery was accomplished by the most primitive methods known to mining, and only from those deposits of lead and zinc carbonate which were found from 20 to 40 ft. below the surface and above the water level. The discovery of large bodies of zinc ore at greater depths by means of churn drills encouraged the installation of modern mining machinery during the past three years, and work has been vigorously pushed over a limited extent of the mineral field.

Mining these ores is very profitable and there are now more than two dozen mines in the district which have paid their owners from 5 to 50% monthly dividends on their capitalization.

In addition to the lead and zinc products of these mines there are produced annually many thousands of tons of other materials which are now treated as waste, because as yet, no provision has been made to save them. Some of these products if properly cared for would be of greater value than the lead and zinc for which the mines are now being solely operated.

Thousands of tons of iron sulphide are found in conjunction with the zinc ore. By the employment of the proper process the iron in this sulphide can be made a valuable product. Sulphuric acid, for which there is an ever increasing demand, is also manufactured from this product. For handling this product there is now but one plant in the district and it is located at Mineral Point, Wis.

Oil rock is found in every zinc range in the district, in layers of from 2 to 12 ft. in thickness. Under proper manipulation this will produce from 30 to 50 gallons of oil and from 4,000 to 5,000 cu. ft. of gas to the ton. The oil is an excellent preservative of wood, makes a good lubricant and can be refined for illuminating purposes. The gas may be used for heating and illuminating purposes, and gives an intense heat and a bright light. The process of separating the oil and gas from the rock, carbonizes the rock which, when ground, forms a pigment resembling graphite. A paint made from this pigment is not affected by sulphuric acid, salt water or any other corrosive element. Some of the smoke stacks in the district are painted with this pigment and have withstood the sulphuric fumes.

Both red and yellow ochres, millions of tons of which are found in the district, need only proper handling to make a valuable product alone.

Under the system of mining leases in vogue in this district, the land owners receive a royalty of 10% of all ores mined as a rental. At the present time there are more than half a hundred land owners in different localites throughout the district whose incomes amount to from $500 to $2,000 per month, according to the output of the mines located on their several properties.

Cuba City, Wis., June 15, 1908. J. V. Welsford.

The Proposed Australian Transcontinental Railway.

Sir: The survey of the Australian transcontinental railway has just been started, and it is not often in the annals of railway construction that a project for a line of such a length is undertaken as a complete scheme.

The Australian colonies of Queensland, New South Wales, Victoria, South Australia, Western Australia, and the Island State of Tasmania federated in 1901, and the four first-mentioned colonies had, long before that date, been connected together by rail.

Western Australia, though by far the largest in area, is, except Tasmania, the smallest in population, and the supposed desert character of its vast interior and especially of the long stretch of country between its settled districts and those of its nearest neighbor, South Australia, has led to its connection by rail with the Eastern States being hitherto in abeyance. Some of the most productive gold fields in the world, however, Coolgardie and Kalgoorlie, were discovered in 1893 in the eastern part of the more settled districts of Western Australia, and a large mining population has been established upon what is now looked upon as a permanent industrial center, and this has been for some years connected by rail with the Western Australian capital, Perth, and its port, Freemantle. Naturally, and more especially since the gold discovery, one of the aspirations of Western Australia has been the connection of her railway system at one of its most eastern points, Kalgoorlie, with Port Augusta, an important western outpost of the railways of the east, a distance of about 1,100 miles.

By the federal constitution, enacted eight years ago, the states were to continue in possession of their lines and to extend them where and when they thought necessary, but power was reserved to the commonwealth to construct, with the consent of the states affected, any line of an intercolonial or strategical character which might be deemed desirable.

The reasons urged by those favorable to the project were five in number. Firstly, in connection with the mail and passenger communication with Europe. At present, the ocean steam services quit the comparatively populous eastern side of Australia at Adelaide in South Australia, where mails and passengers are embarked, picking up only those of Western Australia at Freemantle. If Adelaide and Freemantle were connected by the 1,100-mile missing link between Port Augusta and Kalgoorlie being filled up, the mails and most of the west-bound sea passengers would embark at Freemantle, and the speedier land travel would save at least two days in the through transit. As to the more northern states of Queensland and New South Wales, if a connection were made between the railway systems of the latter and of South Australia at Broken Hill, there would be a further saving of a day as regards the connection between these northern states and Freemantle. If this link were not supplied, this traffic would have to go round by Melbourne and Adelaide. This junction will, no doubt, be ultimately made, though it will leave out the important cities just mentioned from the through route between a large part of Australia and Europe. Then the completion of the Panama Canal has to be considered in this overland scheme, as this will no doubt lead to better ocean services across the Pacific to America from Sydney and other eastern ports of Australia, and the transcontinental railway will enable the Western Australia mails and passengers to participate better in the advantages opened out by the construction of the canal.

Secondly, it is shown that the reduction in distance and cost in the traffic, now large, between the eastern states and the western gold fields which at present is by sea and a retrograde rail journey, would largely increase trade and intercourse between these centers.

Thirdly, there are the very important strategical advantages in the more rapid movements of troops and material in case Australia were unhappily threatened from without.

Fourthly, the transcontinental telegraph now existing along the coast would be more easily maintained by being transferred to the inland railway, and would, in a strategical sense, be much more secure.

Fifthly, the opening up of new tracts for settlement was an important consideration, though, until recent explorations were made, this was thought to be quite an insignificant feature of the scheme.

In 1904, the government of the commonwealth appointed a commission of the six engineers in chief for railways, one from each state to investigate and report. Briefly, they estimated the cost of construction at approximately $24,000,000, that at first the loss by excess of operating expenses over receipts would be annually something like $417,000 per annum, gradually diminishing to zero in about 10 years and afterwards showing a profit, and that four years would be required to construct the line. The gage was recommended to be the standard 4 ft. 8½ ins.

A rough estimate of the cost founded on a mere exploration of so great a length without a survey of any sort, is not so untrustworthy, in this case, as might be expected, as there are said to be no engineering difficulties of any kind, the country consisting of gently undulating surface alternating with flat plains, while the climate being very dry, scarcely any water courses of considerable size have to be bridged. Long experience also of the construction of railways in similar country in Australia, covering thousands of miles, was among the qualifications of the six reporting engineers. As to the annual deficiency, they were on more debatable ground, but it should be remembered that the mere direct receipts of an international scheme of this character are no criterion of its justification.

Whatever may be their financial position now, the construction of the transcontinental lines of the United State, Canada and Asiatic Russia would never have been justified by the sufficiency of early receipts. In the Australian case, leaving aside the first four reasons mentioned above, and dealing with the fifth alone, there is the increased value of the land which practically all belongs to the state, with its natural products, such as timber, minerals, etc. For example, even if the deficit of $417,000 were perpetual, an increase in annual value of the land produced by the construction of the railway, of 3 cts. per acre on a belt of ten miles wide on each side of the line, would pay up the deficiency. This land is worth practically nothing at present, owing to want of transit facilities, so that it is difficult to see why there should be much hesitation in carrying out the undertaking. Moreover, recent investigation has shown that the country is by no means a desert, as was generally supposed, but is wild grassed for a large portion of its length. The supposed dearth of water simply arises from the prevailing limestone formation which leads to the rather limited rainfall being largely lost by percolation, but this can be dealt with, and there are great possibilities in artesian supply as experiments have proved.

As to the gage recommended, it is strange that Australia, like Africa, untaught by disastrous experience elsewhere, should have started its railways from the seaboard to the interior on quite a choice variety in this respect, without apparently giving a thought to their ultimate junction. In the case of two of the most populous states, this was done in spite of the advice of their engineers. Queensland has 3 ft. 0 in. gage, New South Wales 4 ft. 8½ ins., Victoria 5 ft. 3 ins., South Australia 5 ft. 3 ins. and 3 ft. 6 ins., and Western Australia 3 ft. 6 ins. In deciding on 4 ft. 8½ ins. for the transcontinental line which will directly connect two systems each of 3 ft. 6 ins., the commission had in mind the recommendation of a previous commission on unification of gage that, if it were accomplished, the common one would be the standard 4 ft. 8½ ins., with which the new line should agree, but pending that consummation, the later commission are adding two more breaks to the Australian confusion in this respect. The Queenslander bound west for Europe will pass successively in his journey to the port of embarkation over gages of 3 ft. 6 ins., 4 ft. 8½ ins., 5 ft. 3 ins., 3 ft. 6 ins., 4 ft. 8½ ins. and finally 3 ft. 6 ins.

When the commission reported, a proposal was submitted to the commonwealth parliament to grant $96,000 for the cost of a survey, which was eagerly supported by the Western Australian representatives; South Australia was hostile to the measure, as leading to the deprivation of her present possession of the point of arrival and departure of the Oceanic traffic to the westward, while the eastern states, though generally favorable, hesitated over their share of the $24,000,000 expenditure, to which the survey would ultimately lead. The proposal was lost by a casting vote. This decision, reversed last year, has delayed this important undertaking by three or four years.

The survey being now sanctioned, a further conference of the state engineers was held, in which it was recommended that one of two proposed routes, that via Tarcoola, should be adopted, and it was stated that a large area of pastoral and mining country would be tapped, ranging from 117,000 to 120,000 square miles in extent. The railway would enable the country to carry 2,000,000 sheep with the annual wool clip of about 5,300 tons, in addition to which there would be about 100,000 sheep taken to market every year.

There are considerable deposits of gold, copper and coal on the route, and Mr. H. C. Castella, Superintendent of Government Boring Operations, reported the striking of artesian water at a few points, it being reached at about 400 to 500 ft. deep. The existence of large numbers of kangaroos, emus, and wild turkeys in the country to be traversed, which has been reported, shows that it is far from being a desert.

When $80,000 was estimated in 1904 for the survey, the present writer, who has had much experience in superintending similar work in outlying parts of Australia, considered it insufficient. It is true that the actual instrument work will be simple, and probably the present record, which Argentina holds, of the longest tangent, will be beaten on the proposed line, but the distance of transport and scarcity of water must necessarily add greatly to the cost. He is not surprised, therefore, to learn that, in the recent conference, the state engineers have reconsidered their former estimate, and report that the amount voted will be insufficient not only to test alternative routes, but to complete a single one. They recommended that the governments of Western and South Australia should lend their plants and any available engineers, and that their chief engineers should be responsible for the work, while the commonwealth should be represented by a consulting engineer. Twelve months was estimated as the time necessary for the completion of the survey, which, we understand, was to have been started about the middle of the present year.

Very truly,

C. O. Burge, M. Inst. C. E.

24 Park Road, Cheswick, London, June 20, 1908.

[In our issue of Jan. 5, 1905, we published an article on the proposed railway, accompanied by a map, showing both the proposed routes described by Mr. Burge.—Ed.]

Reforms in the Methods of the Public Land Surveys.

Sir: Two years ago, in Engineering News of Jan. 25, 1906, an article was published in which the writer contrasted the work done by the U. S. Land Office with that done by the U. S. Geological Survey to the great disparagement of the former. The letter was accompanied by reproductions of the maps of the respective surveys, which, according to the writer of the article, who had crossed and recrossed the township, showed the General Land Office to be so much in error (showing mountains where lakes existed and vice versa) as to be practically worthless.

Although this is doubtless an extreme case, and may have been due to an error in calling for the township plat, yet I think it is pretty generally admitted (and I am a U. S. Deputy Surveyor myself now engaged in surveying in the Colville Indian Reservation, Washington) that the survey of the public lands has not been such that future generations will ever rise up and call us blessed.

The present method of surveying the public lands, as all readers of the News may not be aware, is to let the work by contract at so much per mile, the price varying with the character of the country, the work being subject to field examination by the Government's expert examiners. Although this has resulted in much better surveys than the old method of letting a contract and taking the surveyor's word, when he turned in his notes, that the work had been done, and the corners well and permanently established, yet it is far from satisfactory. Much work is held up or rejected with consequent delay and vexation to the department, the surveyor and the settler. Then, too, the cost of the examination, no small item, is in a sense a dead weight.

It was doubtless the above-named consideration which led Hon. R. A. Ballinger last year, when Commissioner of the General Land Office, to recommend the doing away with the contract and examining system and in lieu thereof employing surveyors selected by civil service examinations.

While Mr. Ballinger's plan is a good one and the wonder is that it was not only suggested but acted upon years ago, yet after an experience of ten years in executing public surveys, during which time I have worked in three states, I do not believe it would be wise to do away entirely with the examination. The best plan, to my mind, would be to employ civil service surveyors to do the work, and then, in lieu of the present examining service, to organize in the Geological Survey a "Classifying Division" which immediately after the survey of a township would proceed to make a geological survey of the same and before any patents are issued classify the land as "agricultural," mineral" or "timber," estimate the hydrographic resources and incidentally check the survey. Any work found to be inaccurately or carelessly done would result in the dismissal of the surveyor thus found derelict.

Such an examination would practically cost nothing, not alone for the reason that in some instances it would come in as a part of the "quadrangle" work of the Geological Survey, but for the greater reason that it would save to the public many timber, mineral and water-power resources now surreptitiously passing to private ownership; or if sold they would be sold at a proper value. It would, in short, be in line with policy of the "Conservation of Natural Resources" and make possible the intelligent disposal of the public domain.

The reason I do not believe in doing away entirely with the examination is that two kinds of honesty are involved in the execution of a survey in rough, mountainous, and little frequented sections of the country; the usual brand, measured in units of dollars and cents, and another brand measured in units of hard work, sweat and weariness of body. Doing away with the contract system would eliminate the first source of dishonesty, but the second would remain.

Two instances will make my meaning clear. One is of a surveyor who employed a compass-man. The work near camp was well done, but when it came to that more remote, the party would go a distance from camp, get in the shade, play cards, and make up notes of what would appear to be a day's work. The other story is of an examiner who was conveniently "taken sick" when about to proceed to the examination of a remote and difficult township. The senior assistant went ahead two or three miles, turned off the trail, made a camp, faked up notes from those of the deputy, and came out. Both these instances were told me by a member of each party.

Honesty of the most rugged character, persevering industry, experience and skill will be required in the engineer who would survey a rough, mountainous and remote township which is not to be subject to field examination. That all who pass the civil service will have such a character it is not reasonable to expect.

H. A. Rands.

Oregon City, Ore., June 19, 1908.

Concerning Federal Control of Water Power Development in the National Forests.

Sir: I note your editorial comment of July 9, 1908, on my paper on Water Power Development in the National Forests, read before the American Institute of Electrical Engineers, and note particularly your last paragraph referring to the discussion as follows:

> These men largely trained to the service of private interests held to the principle that it was for the good of the country that the revenue from all profitable developments on government conserved areas should contribute, without respect to geographical distribution, to the upbuilding of mutilated or wasted power sites.

And in the report of the discussion on page 43, you say:

> There was a general consensus of opinion that it was for the greatest good of the greatest population; that "spoiled" and hitherto useless water-powers in the East should be assisted to a paying basis of development by revenues on western power privileges, as one man would take income from one paying property and use it to build up another poorer property to a paying basis thus making his whole possessions more productive.

This policy pursued to its limit would tax our Western farms to increase the productiveness of those in the East which are worn out. It would tax the productive coal and other mines to keep the others on their feet. And in general it would tax our Western resources to the advantage of the East where the resources have been exhausted or wasted. The end would be that the thrifty men would be taxed to support the less thrifty—that is government equalization of everything—that is paternalism or socialism. The Western people will as a whole oppose a tax on Western resources to support those of the East. We say to the people of the East, "If you wish to benefit from our resources, come out here and help develop them."

California has no coal, but abundant water-power. We do not expect Pennsylvania to tax its coal resources for our benefit, nor do we wish our water-power resources taxed for Pennsylvania's benefit. The waters of the states belong to the states and are controlled by the state, except for navigation, and use of the water is, therefore, a local resource. How then can the United States charge a privilege or franchise tax for something which belongs to the State?

Whether considered as a local or a national resource, each hydro-electric horse-power saves so much coal, oil or wood and preserves the resources to this extent.

So far as the power companies are concerned, it would probably be better to have one tax by the Federal Government and have all waters regulated by the general government. At present the States can impose a tax, also the counties and cities, and they are not going to recede this right. If, in addition, the general government imposes a tax, there will be four independent taxing powers—Federal, State, County, City, the total of which may be as high as 10% of the gross revenue, as all of them are based on the gross, and not on the net, revenue. The plain fact is that, with the Federal, State, County and City governments each reserving an independent right to tax the power companies, the investor will reserve the right to keep his money.

The work done by power companies develops the forests by building roads, trails, telephone lines, protecting forests against fires; it helps the streams by the construction of reservoirs, and hence helps irrigation, farming, etc.; it helps the industries by equalizing conditions, reduces the cost of power and adds taxable property to the counties and states in which the developments take place, and in doing so makes use of resources now absolutely going to waste, and substitutes this waste power for coal, oil or wood.

It should be remembered that power companies must generally open up the country and expend many thousand dollars building trails, roads, telephone lines, etc., all of which the government uses free of charge, and the people benefit by the roads and other development, making the country accessible. The interest of the power company generally requires stream regulation by the construction of reservoirs. This stream regulation is of benefit to the farmers and to the entire country by preventing floods and conserving the water for the low water periods. The power companies are constructive and not destructive. They add to the population and industry by lowering the price of power and making the power available over a large territory.

The Forestry Department only gives temporary permits, and most investors will not risk their money. To subject the investments to the whim of some official many thousand miles away is unjust, as is also an arbitrary charge on the power output for Federal purposes. To subject an investment of this kind to arbitrary taxation by the Federal, State, County and City governments means confiscation or bankruptcy. There is a story of the goose that laid the golden egg.

A knowledge of conditions is necessary for an intelligent discussion of the subject. This fact is shown by the criticisms to my paper. Eastern men say I am too much in favor of the power companies; Western men say I am asking the power companies to do too much.

Yours very truly,

F. G. Baum.

1405-7 Chronicle Bldg., San Francisco, Cal., July 15, 1908.

[We do not think our correspondent can make a sectional issue out of the question which he raises. It is neither paternalism nor socialism for the Government—Federal, State or Municipal—to care for public property on business principles; and when private interests want to make use of property belonging to the whole people they ought to pay a fair price for the privilege.

To be sure this principle has been often ignored, so we have our municipalities giving away valuable franchises in perpetuity, and the Federal Government selling for a merely nominal price lands and mines and forests and water powers to whoever applied for them first. But the world moves, and things which "went" twenty years ago do not go to-day.

The people of the West are the very last ones to protest against the Federal policy, put in force by the present administration, of saving the coal mines and water powers and forests from monopolistic control by great corporate interests. It is true these "interests" often have a very large voice in politics—witness California for example—but they cannot claim to represent public sentiment as a whole.—Ed.]

Concerning Public Debts.

Sir: The editorial in your issue of 16th inst. on the above subject is interesting and timely. Most engineers will agree with you in the abstract, but I am unable to follow your argument fully as to the desirability of paying off all municipal debts within fixed periods.

The laws of Missouri and many other states provide that when bonds are issued provision must be made for taxation to cover both the interest and a sinking fund sufficient to retire the bonds within 20 years. I do not question the wisdom of this rule, as a general proposition, but in some cases it works hardships.

Take for instance municipal vs. private ownership of water-works, which I have had occasion to study in some detail. Besides meeting all ordinary operating expenses the city must maintain the plant in good operative condition—that is, it must either make good all depreciation, or charge it off—and it must pay interest on the water bonds, and also set aside a sinking fund sufficient to retire them at maturity. The only way this can be done is to make the water rates sufficiently high. At the end of the 20-year period, the city becomes the owner of the plant without indebtedness. The last generation has made a present to the next generation of a complete plant—in most cases a "going," successful business.

It is of course true that the coming generation should not be saddled with the unproductive debts of the past, but is it not equally unfair to require the present generation to tax itself for the benefit of future generations? A private company need give itself no concern about actually paying off its bonds, so long as it has an income sufficient to meet its interest, maintain the plant, and take care of depreciation, thus keeping the security intact. To this extent it has an important advantage over a municipality, and is therefore in a position to make lower rates. The sinking fund account would much more than offset the difference in interest rates between a municipality and a private corporation.

Is there any legitimate reason why rates should be higher than actually required to meet operating expense, depreciation and interest? Why insist upon ac-

tually paying off such bonds so long as they are amply secured by the actual physical value in the plant, which is in regular and successful use, with a large patronage in water—a commodity which in all probability will always be a prime necessity in urban life? The argument, of course, is not as strong for other public utilities, such as gas, electric light, railways, telephone, etc., which are subject to fluctuating and sometimes erratic demand, mutations as to improvements in methods and processes, rapid deterioration, etc. With more justice it might be said that the extensions and betterments necessary in all growing cities, might properly come out of earnings, but strictly speaking even this is doubtful, and would better be met by additional bond issues.

William H. Bryan.

707 Lincoln Trust Bldg., St. Louis, July 18, 1908.

[To us it is one of the strong arguments against private ownership of public utilities that the cost, represented by bonded indebtedness, is made a perpetual burden on the public. With interest rates at 4%, it only requires a sinking fund contribution of 3⅛% per annum to extinguish a bond issue at the end of 20 years. Few franchise holding companies can float bonds at a lower rate of interest than 5⅛% on the average, when discounts, etc., are taken into account. With a city floating its own bonds at 4%, therefore, a contribution of only 2% per annum under municipal ownership would extinguish the bond issue in 20 years and leave the city freed, forever, from the burden of further interest payment on account of this particular debt.

Further than this, we need only look back 20 years to see that cities to-day need to have their power to borrow money by bond issues unhampered by debts incurred 20 years ago. Take this very matter of water supply: In 1884, New York City built the new Croton Aqueduct to obtain an additional water supply. Twenty years later the city found the capacity of this work overtaxed and the chance of a water famine threatening, and was obliged to plan enormous new works for additional supply.

With the rapid changes of our present day civilization, each new generation has its own needs. Within the next ten years our cities must undertake an enormous amount of work in sewage disposal, in water purification, in garbage treatment, in additional facilities for city transit and for commerce. The city or the state or the nation that allows a mountain of debt to be piled up by generation after generation will suffer a serious handicap in the competitive struggle.

A distinguished engineer once remarked that it was not to be expected that the average of private property could be very much raised. The only way in which living conditions can be bettered and wealth accumulated by people as a whole, said he, is for the Government to possess the accumulations in the form of the means of transportation and communication, and free of debt, so that the people as a whole shall have the free use of them.

The lesson is still more powerfully enforced when one studies conditions in the older civilizations of Europe, where one sees the accumulated industry of many centuries. Suppose all the work of the Middle Ages in the castles of feudal warfare—quite as necessary in their day as any public work that we now build—were to be still represented by bond issues.

We believe the Missouri statute referred to by our correspondent is based on sound principles of public finance, although a redemption term of 20 years for all bonds, regardless of purpose of issue and life of plant, may be unwise.—Ed.]

Tests on the Water Retaining Ability of Stone and Concrete.

Sir: In your issue of June 18, 1908, p. 670, under the title Advantage of Porous Brick in Brick Walls, attention is called to the effect of fine-pored brick in retaining water, through capillary attraction, and the consequent danger of injury from freezing.

During the past year the writer has had occasion to make laboratory tests, under the organization with which he is connected, of the comparative merits of several types of stone and of concrete blocks under consideration of dam facing materials. It was recognized that the percentage of water retained, under conditions where opportunity for drainage exists, rather than the total amount of pore space might afford the better measure of the effects of freezing. The scheme of laboratory investigations included the determination of the above factor. Without going into details the tests may be described as follows: The object was to determine the comparative and actual rates at which saturated stones give up their water under ordinary conditions of temperature and atmosphere. The results were expressed, for want of better terms, as the Ratio of Drying and the Weight of Retained Water per Cubic Foot of Stone. Samples were saturated, weighed and exposed to laboratory air and weighed at periods of 24 and 48 hours, then dried at 110° C. and weighed. The ratio of drying was computed by dividing the weight of water lost during exposure by the total weight absorbed. The weight of retained water per cubic foot of stone was computed as it is evident, considering the varying specific gravity of different rocks, this gives a truer volumetric relation than does a ratio of weights. The value of this test rests on the assumption that during the period of drying the water of the larger or capillary pores is removed and the portion remaining fills all or part of the sub-capillary pores to their capacity and is potent for injury on freezing. It is evident that two classes of rock differing in composition or origin, for example, sandstone and granite should not be compared by direct quantitative results of either porosity or ratio of drying, but it is thought these tests do afford a valuable means of comparing specimens of essentially similar types, and that the rate at which included water is given off, as determined by the drying test and expressed as weight of retained water per unit volume of stone, is of more value than the porosity test. The results should be interpreted by comparison with the ratio of absorption, commonly but erroneously called the porosity test.

The following table gives typical results from one of the series of tests:

Rock.	Per cent. of water absorbed.	Ratio of drying. 24 hrs.	Ratio of drying. 48 hrs.	Retained water, lbs. per cu. ft. 24 hrs.	Retained water, lbs. per cu. ft. 48 hrs.
Granite	.26	49.45	52.80	.224	.210
Gneiss	.30	88.16	88.16	.057	.057
Gneissoid granite.	1.08	86.70	88.20	.252	.215

The writer believes failure to provide for this test to be a deficiency of current specifications for concrete building blocks, and hopes to see some action taken to establish standards for this method of testing. For a very instructive discussion of the relation of pore space and size of pores in stone to retain water the writer makes acknowledgment to Bulletin No. 4 of the Wisconsin Geological Survey, by Dr. E. R. Buckley, published in 1898.

Very truly yours,

James L. Davis, Assoc. M. Am. Soc. C. E.

Board of Water Supply, New York City, July 13, 1908.

Data on the Silting Up of Reservoirs.

Sir: In your issue of July 23 there appears a query from C. H. M., Seattle, Wash., regarding the silting up of reservoirs.

Information of this character is given in various government publications. In Water-Supply and Irrigation Paper No. 40 ("The Austin Dam," by T. U. Taylor) several pages are devoted to an interesting and valuable discussion of the silting up of Lake McDonald, Tex., the reservoir formed by the Austin dam which failed April 7, 1900. This discussion contains cross-sections at 15 different points, ranging in distance above the dam from zero to 18.9 miles. At most of these sections three separate sets of soundings had been made at intervals of a few years. This paper can be consulted at almost any of the larger libraries of the country, or it can be purchased from the Superintendent of Documents, Washington, D. C., upon remitting 15 cts. by post-office order.

In the Third Annual Report of the Reclamation Service is given information regarding silt in Lake McMillan Reservoir, New Mex. This reservoir has a record of having silted up 60% in fifteen years.

It is interesting to compare the silting of these western reservoirs with that of the distributing reservoir of Washington, D. C. In a period of 20 years the bottom of the upper or settling division of the distributing reservoir was raised about 9 ins. The lower division was raised about 4 ins. in the same time. The deposits diminished the capacity of the reservoir 8,000,000 gals. (See Annual Report of the Chief of Engineers, U. S. Army, Part VI., 1893, page 4297.)

Very truly yours,

R. H. Bolster,

Assistant Engineer, U. S. Geological Survey.

Washington, D. C., July 24, 1908.

Salaries of Technical Graduates.

Sir: I noticed a few days ago a statement of the average earnings of the graduates of one of our technical schools. The writer made up a table of the earnings of the graduates in the Mechanical Engineering Department of this institution for the ten years from 1895 to 1905. The data was collected about eighteen months ago and the only change possible would be that the average rate of wages is considerably higher at the present time.

Very truly yours,

L. S. Randolph, M. Am. Soc. C. E.

Professor of Mechanical Engineering, Virginia Polytechnic Institute, Blacksburg, Va., July 25, 1908.

[The table referred to is printed below.—Ed.]

Positions and Earnings of Graduates of the VIRGINIA POLYTECHNIC INSTITUTE Department of Mechanical Engineering.

(Made September, 1906.)

Positions.	
Presidents	2
Superintendents and assistant superintendents	10
Managers	3
Teachers	6
Mechanical engineers	32
Inspectors	3
Marine engineers	4
Civil engineers	5
Electrical engineers	7
Mining engineers	3
Draftsmen	20
Clerical	1
Apprentices	2

Class.	Average salary.
1895	$4,633
1896	1,336
1897	1,400
1898	2,500
1899	2,020
1900	2,000
1901	1,397
1902	1,332
1903	1,004
1904	1,077
1905	801
Average	$1,774

Notes and Queries.

Referring to the article on the Georgian Bay Canal in our issue of July 16, it should have been stated that the official report was presented to Parliament by the Minister of Public Works, under whose direction the surveys were carried out and not by the Department of Railways and Canals as stated.

I. B. D., Mineral Wells, Tex., wishes a simple method of detecting sulphate of alumina in water in which that substance has been used as a coagulant. We doubt if there is any satisfactory method that could be called "simple" from the viewpoint of the layman. The following methods, however, are given in "Air, Water and Food," by Ellen H. Richards and Alpheus G. Woodman:

Dissolve about 0.1-gram pure hematoxylin in 25 c. c. water; this solution will keep for two weeks and works best after being made several hours. To 50 c. c. of the water, placed in a 4-in. porcelain dish, add two drops of the hematoxylin solution, allow the solution to stand for one or two minutes, then add a drop of 20% acetic acid. The standards are prepared at the same time, using 50 c. c. of distilled water and the required amount of a standard alum solution. The comparison must be made immediately, since the color fades on standing. In this way the presence of one part of aluminum sulphate in 5,000,000 can be determined directly in the water and with ease.

Logwood itself can be used, but the test is not so delicate as with the hematoxylin. Boil 5 grams rasped logwood repeatedly with 50 c. c. of water; reject the first four decoctions, saving the fifth for use. This solution is used in the same way as the hematoxylin solution, but the fainter colors are not so easily seen, on account of the greater color of the logwood solution itself. The logwood solution must be freshly prepared each time. It will work satisfactorily only for about two hours.

Notes.—This test will show the presence of all soluble salts of aluminum which enter into combination with the coloring matter of the logwood to form a "lake."

The alkalies and alkaline earths give a purplish color with logwood extract, hence the test for alum can be made only in acid solution.

THE VARIATIONS IN RATES OF WAGES since 1890, measured not in dollars, but in purchasing power, are set forth in Bulletin 77, just issued by the U. S. Bureau of Labor. The following table summarizes the result of the investigation:

RELATIVE WAGES PER HOUR, RETAIL PRICES OF FOOD, AND PURCHASING POWER OF HOURLY WAGES, MEASURED BY RETAIL PRICES OF FOOD, 1890 TO 1907.

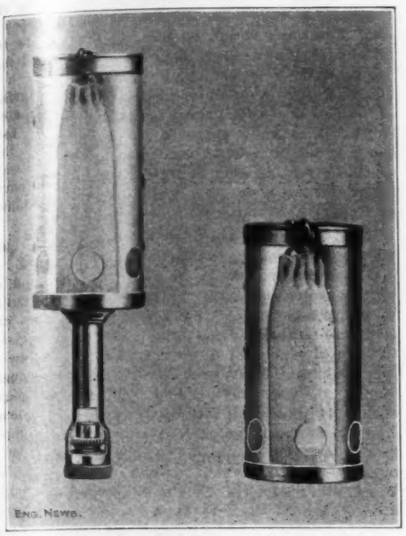
[Relative numbers computed on basis of average for 1890-1899 = 100.0.]

Year.	Wages per hour.	Retail prices of food weighted according to family consumption.	Purchasing power of hourly wages measured by retail prices of food.
1890	100.3	102.4	97.9
1891	100.3	103.8	96.6
1892	100.8	101.9	98.9
1893	100.9	104.4	96.6
1894	97.9	99.7	98.2
1895	98.3	97.8	100.5
1896	99.7	95.5	104.4
1897	99.6	96.3	103.4
1898	100.2	98.7	101.5
1899	102.0	99.5	102.5
1900	105.5	101.1	104.4
1901	108.0	105.2	102.7
1902	112.2	110.9	101.2
1903	116.3	110.3	105.4
1904	117.0	111.7	104.7
1905	118.9	112.4	105.8
1906	124.2	115.7	107.3
1907	128.8	120.6	106.8

A NEW INCANDESCENT GAS BURNER.

From time to time the manufacturers of gas lamps indicate their alertness in putting into practical shape each advance gained in the use of illuminating gas. The practical forms of the inverted mantle burner gave evidence of this some time ago, and the new burner placed on the market by the Welsbach Co., of Gloucester, N. J., strengthens the impression.

This burner, known as the "Junior type," is one of the smallest and most adaptable of the



A Small Incandescent Gas Lamp to Replace Fish-Tail Burners.
(Made by The Welsbach Co., Gloucester, N. J.)

mantle lamps yet developed. The general arrangement is shown in the accompanying figure. The whole arrangement is intended to replace the burner and tip of the ordinary fish-tail flame, the mantle occupying the same relative place as the flame. This burner can therefore be used with any glassware of the open-flame or electric-bulb fixtures, provided there is free discharge of burned gases upward. No change in the fixture is required other than removal of the burner.

The arrangement, as shown, consists essentially of a Bunsen burner, a chimney and a mantle. The design is extremely simple; the mica chimney is the integral support of the mantle, and this unit slips into its place on the top of the Bunsen burner. The whole outfit is about 5 ins. high. The burner uses from 1.75 to 2.0 cu. ft. of gas per hour and gives about 25 to 30 mean spherical c. p. The distribution of light is, of course, very similar to the older form of upright mantle lamp. On account of the great intrinsic brilliancy of the exposed mantle of this "junior type," a word of warning should be given where it is to replace the old fish-tail burners. The glassware should be examined to see whether it is too nearly transparent or not. If such is the case then, in most instances, the proper diffusion can be obtained by additional sand blasting, etching or even lacquering. The intrinsic brilliancy of all mantle lamps is too great for their use without every precaution against injury to the eyes. The burner is marketed at a retail price of 35 cents, and it is claimed that the mantle gives a life of about a year under ordinary use—which, probably, may be taken to be from two to four hours per day.

THE ASPHALT PRODUCTION OF THE UNITED States in 1907 amounted to 223,000 tons, valued at $2,826,000 against imports of 160,000 tons valued at $618,000. Four years ago, according to a press bulletin of the U. S. Geological Survey, the total production and importations of the United States aggregated only 240,000 tons. During the year 1887, only 4,000 tons were produced in the United States, and in 1807 less than 70,000 tons.

THE HARLEM CREEK SEWER AND ITS STEEL CENTERING: ST. LOUIS, MO.

The Harlem Creek Sewer, in St. Louis, Mo., is thought to be the largest concrete sewer built in this country, and the part now under construction is notable for the use of steel centering. The Harlem Creek is a small stream in the northern section of the city, draining a district which is mainly open country. It receives, however, both sewage and the refuse from some industrial establishments, and is also subject to flooding by heavy rains. In view of these conditions, and of the future development of this part of the city, it was decided by the Sewer Department to build a conduit to replace the present open channel. Mr. H. R. Fardwell is Sewer Commissioner; Mr. J. A. Hooke, Assistant Sewer Commissioner; Mr. Ross M. Bristol, Engineer of the Sewer Department, and Mr. S. W. Shinkle, Engineer in Charge. Mr. John King is Chief Inspector. Fig. 1 shows cross-sections of the sewer.

The first section of the sewer, extending from Broadway (at Bircher St.) to the Mississippi River, was built by the Hoffman-Hogan Construction Co., and has been completed this month. It is 2,200 ft. long, with a span of 29 ft. at the springing line, and was built with the usual form of wooden centering. This section is now in use, there being a lateral inlet at its upper end.

The second section, work on which was commenced a few months ago, will be 3,000 ft. long, extending west and northwest from Broadway. It follows the course of future streets, and has two bends or changes of direction in its length of 3,000 ft. The grade is 0.25%. There will be about six manholes, placed at the side of the sewer. This section is 25 ft. wide, with a semi-circular arch, and a total height of 17 ft. from the invert to the crown. It is being built by the Prendergast Contracting Co., of St. Louis.

Work was commenced at the lower or Broadway end, the connection with the first section being closed by a dam of vitrified brick in cement, in order to prevent flooding of the new work by water backing up from the river in time of flood. Below this dam is the concrete

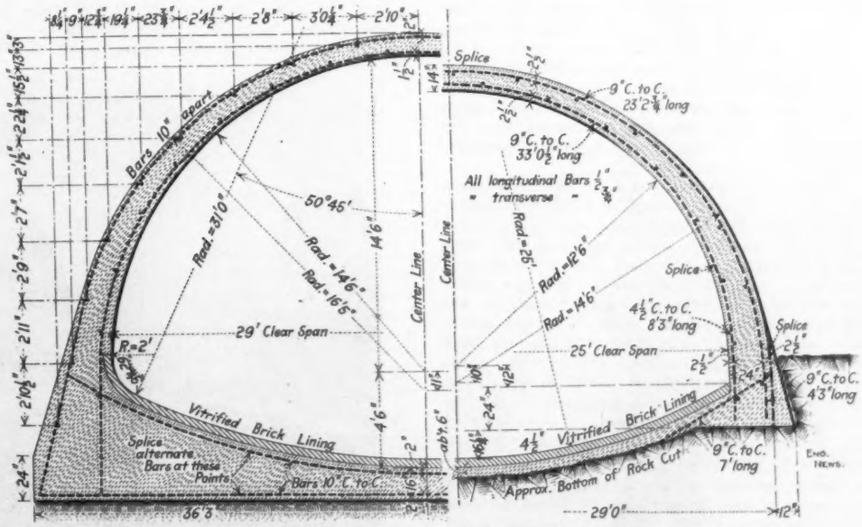


FIG. 1. CROSS-SECTIONS OF THE HARLEM CREEK SEWER, ST. LOUIS, MO.

inlet by which the stream now enters the first section of the sewer. The excavation averages about 33 ft. wide at top, and ranges from 25 ft. to 50 ft. in depth.

CONCRETE WORK.

The section is uniform throughout. There is a semi-circular roof of 25 ft. span, with vertical sides extending below the springing line for about 1 ft. The invert has a radius of 25 ft., and is faced with a single course of hard-burned vitrified paving brick. This use of vitrified brick is standard in all brick and concrete sewer work at St. Louis. The thickness of the concrete is 14 ins. at the crown of the arch, 26 ins. at the springing, and 6 ins. at the lowest part of the invert. The concrete is made of St. Louis "Red Ring" Portland cement, Mississippi River sand and crushed limestone (¼-in. to 2-in. in size); the proportions are 1:2:5 for the arch and 1:3:6 for the invert. It is mixed fairly wet to enable it to be packed closely around the steel reinforcing bars. The reinforcement comprises curved transverse rods near the intrados and extrados of the arch, with longitudinal bars wired to them. Vertical bars are set in the haunches. Twisted bars are used throughout, while Johnson corrugated bars were used in the first section.

The concreting of each 25-ft. length of the arch is done at one operation, no stoppage being allowed until the work is complete. The two cableways (described farther on) deposit the concrete on opposite sides, working backward and forward along the 25-ft. length. A gang at the crown attends to the dumping of the buckets and pushing the concrete down the sides. Two gangs, one on each side, tamp the concrete into place with wooden bars.

STEEL CENTERING.

One of the special features of the construction work is the use of steel centering, the steel structure being collapsed, moved ahead, and expanded as the work progresses. The present centering is 25 ft. long, but another 25-ft. length has been ordered, and it is intended to build the arch in 50-ft. sections. The centering is of the Blaw type, built by the Blaw Collapsible Steel Centering Co., of Pittsburg, Pa. The weight of the 25-ft. length is about 15 tons. This type of centering has been used extensively on smaller work, but this is the largest diameter that has yet been built.

The centering consists of a steel shell riveted to arched ribs of steel channels. As shown by the view in Fig. 2, the interior framing is composed principally of two sets of truss frames, one on each side. The straight chord of each truss extends diagonally from the crown to the horizontal member at the springing line, and the arch rib forms the curved chord. The web members are secured to the chords by connection plates. These truss frames are spaced 30 ins. apart. On each side of each arch rib is an angle rib having one leg riveted to the side of the channel and the other leg riveted to the shell plates. Stiffness is further secured by an intermediate channel rib between each pair of main ribs. Across the central triangular space, between the two inclined chords of each pair of frames, are placed three horizontal timber struts, in line with the horizontal truss members. These struts carry screw jacks. In

this way the frames can be extended to give the shell the full diameter, or can be drawn inward so as to contract the diameter and thus free the shell from the concrete arch which has set around it. At the forward end of the shell is a curved bulkhead of steel plates, against which the concrete is laid.

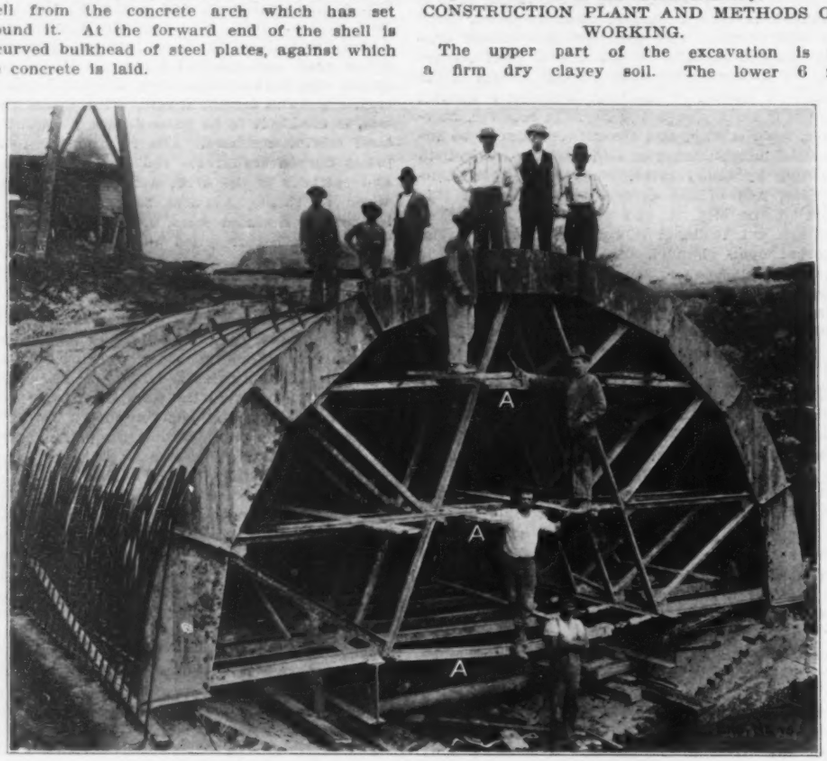


FIG. 2. STEEL CENTERING FOR THE 25-FT. HARLEM CREEK SEWER AT ST. LOUIS, MO.
(At A are the three lines of struts, with screw jacks for spreading and collapsing the centering.)

Under the lower end of each row of chords is a longitudinal 24-in. I-beam. These afford ample longitudinal stiffness or rigidity. They are provided with small wheels which run on steel angles spiked to longitudinal timbers laid upon the invert. When in place, however, the I-beams are raised by jacks placed under their ends, in order to give the centering its proper vertical position. They are then supported by the jacks and by blocking while the concrete is being deposited and until it has set. The centering must remain in place for at least three days after concreting, but the actual time depends upon the rate at which the construction of the invert progresses.

When ready to move, the horizontal jacks draw the sides of the shell inward, and (the blocking being removed) the vertical jacks under the I-beams lower the structure bodily about 6 ins., until the rollers rest on the steel angles which form the rails. It is then hauled forward one length by means of a cable. With four laborers, the 25-ft. centering can be collapsed, moved ahead, and set up ready for concreting in less than two hours. It is expected that equally rapid work can be done with the 50-ft. section. The arch is left with a smooth and even finish, free from irregularities of surface. The exterior of the shell is oiled to prevent the concrete from sticking to the steel.

Timber is used to form the outside face of the form at the haunches. The joints between the planks are calked with clay, and the joints with the steel end bulkhead are closed in the same way to prevent the escape of water and cement when the concrete happens to be very wet.

The excavation is kept well ahead of the centering and a 25-ft. length of the bottom is first built. When the lower part is completed, the reinforcing bars for the invert are set in position, the form is placed, and the concrete is filled in to form the invert of the sewer. The brick lining is also set in place. After this part of the work has set for a sufficient time, the supports for the arch centering are laid upon it, and the centering is hauled forward as described above. Pumps mounted on the centering keep the bottom of the excavation dry.

CONSTRUCTION PLANT AND METHODS OF WORKING.

The upper part of the excavation is in a firm dry clayey soil. The lower 6 ft. is in solid limestone rock, and this rock depth will increase to about 8 ft. Immediately above the rock is a bed of stiff blue clay, which is difficult to handle, as it sticks in the 1¼-yd. bucket of the steam shovel. This is a Little Giant machine, carried on traction wheels. It is now intended to excavate to the rock by means of large slips or scraper buckets handled by a cable from a hoisting engine; and to use the steam shovel to load the rock broken up by blasting. At present the rock is broken by blasting and sledging into sizes small enough to allow of loading by hand into skips or buckets. The rock is used for the concrete, and some of it is sold for use elsewhere.

Fig. 3 is a view of the work in progress. In front is the steam shovel, and beside it is the steam drill used in breaking up the rock bench. In the excavation behind the steam shovel is the steel centering. Behind this again is the end of the completed concrete sewer, partly covered by the back-filling. Overhead are the two cableways which handle the excavated material and the concrete buckets.

Fig. 4 is a sketch plan of the construction plant, which is of interest for its combination of cableways and narrow-gage industrial railways. It may be noted in this connection that there is an increasing tendency to use railways of this class on construction work in this country, following a practice which has been common in Europe for many years.

The concrete-mixing plant is located permanently at about the middle of the work. A No. 3 Gates crusher is set below the ground, so that the men can feed the stone directly into it. A conveyor carries the crushed stone to the overhead screens, from which the stone passes to a row of elevated bins. Adjoining these is the sand bin. The cement and sand are brought in by railway cars. The cement (in paper sacks) is delivered into a storage shed alongside the track. The sand is shoveled or dumped into a concrete hopper forming the boot of a bucket elevator which delivers it to the elevated bin. Underneath the bins and extending around to the cement house is a narrow-gage track on which run two small side-dump charging cars. One car is loaded with the proper amount of cement, and then runs under the spout of the sand bin. The other car is filled from spouts under the stone bins, taking stone from different parts of the bins in order to ensure a proper proportioning of the different sizes.

At one side of the charging car track is the concrete mixer. This is a Chicago cube concrete mixer, of 1¼ yds. capacity, and has an elevating charging hopper operated by a cable hoist. The sand, cement and stone are dumped into this hopper, which is then raised and automatically discharges its contents into the revolving cubical box. Water is supplied from an

FIG. 3. STEAM SHOVEL, CABLEWAYS AND STEEL CENTERING ON THE HARLEM CREEK SEWER WORK.

elevated tank having a long water-glass gage. Graduations (on the tank) at the side of this gage show the quantities of water required for a dry, medium and wet mix. One man at the mixer controls the charging hopper, the mixer, the water supply, and the car elevator noted below.

The method of handling the concrete and the excavated material is of interest, being a combination of narrow-gage gravity tracks and cableways. Extending over the line of the sewer are two parallel Lambert cableways 500 ft. long. From the concrete mixing plant to the head of the cableways is a gravity loop track for Koppel narrow-gage flat cars carrying Koppel bottom-dump concrete buckets of 1¼ yds. capacity. The lowest point of the track is at the concrete mixer. When a car has received its charge of concrete (by tilting the mixer),

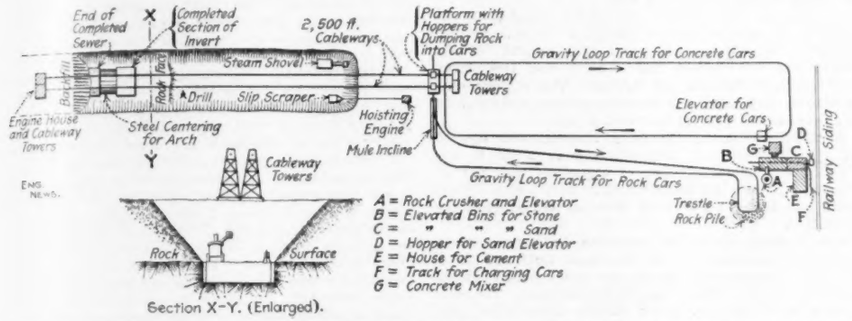


FIG. 4. SKETCH PLAN SHOWING THE ARRANGEMENT OF THE CONSTRUCTION PLANT FOR THE HARLEM CREEK SEWER; ST. LOUIS, MO.

it is pushed forward to a platform elevator which raises it to the head of the gravity track. A man then starts it down a short grade of about 1%, beyond which there is a grade of 0.05% to the level portion near the cableway. Here two laborers check the car in position under the hoist of one or other of the cableways.

The bucket is then lifted from the car and run out to the desired point, where it is lowered and dumped. The empty bucket is run back and dropped upon a car, and the two men then start it on the gravity return track from the cableway to the concrete mixer. At present the distance from the cableway to the mixer is about 800 ft., and there are in all about 4,000 ft. of the industrial railway. A man stationed at the back-filling dump, directs the cableway enginemen by signs. Another man, on the platform at the forward end of the cableway, signals the former as to hoisting and lowering movements of the buckets. He also signals the man at the car elevator when to start a loaded bucket of concrete.

The rock from the excavation is used for concrete, as already noted. It is loaded into buckets, which are carried by the cableways to a dumping platform having chutes through which the rock falls into steel side-dump Koppel cars of 40 cu. ft. capacity. The car runs by gravity to a trestle over the rock pile at the crusher. When empty, it passes round a loop to a return gravity track. This ends near the loading point, and a mule hauls the car up a short incline to this point, under the platform. The earth excavated is loaded by the steam shovel into buckets of 36 cu. ft. capacity. These (as well as the large excavating slip scrapers already mentioned) are raised by the cableway and carried back to the completed part of the work, where the material is dumped for back-filling.

The excavating and removal of earth, and the removal of rock, are carried on at night. The concreting and rock excavation are done during the day. Arc electric lights are erected on poles along the work. Electric motors are used to operate the rock crusher, elevator and screens, the concrete mixer and its charging hopper, and the car elevator. Current is obtained from the Union Electric Light & Power Co., of St. Louis.

THE RELATIVE HYGIENIC VALUES OF GAS AND ELECTRIC LIGHTING.*

The most complete study of the relative merits of gas and electric lighting for domestic purposes from the hygienic standpoint yet made is that presented recently by Dr. Samuel Rideal before the Royal Sanitary Institute in London. The report makes a formidable document of 132 pages, exclusive of plates. The interesting methods employed and the (to most persons) unexpected conclusions drawn make a study closer than can be made here advisable for sanitarians and electrical engineers generally.

PURPOSE AND SCOPE OF THE STUDY.—To properly determine and compare the hygienic effects of the two ways of lighting it was considered necessary to study direct physiological actions and less direct effects through changes in the living conditions. For this study three parallel lines of research were requisite: (1) into the direct effect of the light; (2) into the effect of the products of combustion, respiration, perspiration, etc.; (3) into the nature, amount and distribution of such products. The work was increased through the unexpected lack of data on such points as the ventilation of living rooms or results of physiological examinations of normal persons at their regular avocations. This investigation was carried out with 15 persons altogether. These men underwent a general medical examination to show that they were normal examples of men living and working in a city like London. The physical data collected related to (1) lighting, (2) heating, (3) ventilation, (4) composition of the air. The physiological data included: (1) frequency and character of pulse, (2) frequency of respiration, (3) arterial blood pressures, (4) variations in blood contents, (5) body temperatures, (6) body weights, (7) mental fatigue, (8) time lag between mental impulse and muscular action, (9) impressions on the senses, (10) eye fatigue.

EQUIPMENT.—The experiments were carried on in the basement of an office building in London. Two rooms (14 × 16 ft.) had previously been thrown into one large apartment in which the first studies were made. Later two equal and symmetrical rooms were formed by a wooden partition and screens. The front wall was the only outer one and had two large windows in each room. Outside each corridor, an air lock was formed, by baize doors, to minimize the air disturbance of persons entering and leaving the room. To exaggerate any unhygienic effects of either system the ventilation was restricted to a small adjustable grating, besides the unavoidable leakage around window openings. Before taking over the rooms they were cleaned and whitened, a normal amount of about 50 lbs. of whiting (an average of 40 sq. ft. per lb.) were used on walls and ceiling.

At first the rooms were not heated, but as severe weather intervened some source of warmth other than the lamps and bodies of the subjects was demanded. To still control the ventilation electric heaters were used, supplied through a separate meter.

Each room was arranged to be lighted by either gas or electricity and the supply of both was recorded by close-reading meters. The lighting was that of an ordinary dining-room; in the center of each room a pendant hung over a large table around which the men sat. This fixture carried a flounce inside of which were two gas and two electric lamps, alternated. The gas lamps had "25-c. p." inverted, mantle burners and used 1.28 cu. ft. of gas per hour. The ordinary coal gas supply (3.2 c. p. per cu. ft. per hour) was used. The electric lamps were carbon filament bulbs having a normal power consumption of 94 watts for a nominal 25 c. p.

ARRANGEMENT OF EXPERIMENTAL WORK.—With the single large room gas and electric lighting was used alternately from night to night or from week to week. After the two symmetrical rooms were arranged gas was burned in one room when electricity was used in the other. The use of gas or electricity was alternated to overcome differences resulting from the use of the two rooms without change. The following physical studies were made: (1) Photometric tests of the lighting, (2) temperature gradients about the room, (3) amounts of air supplied before and after each evening's run, (4) amounts of CO_2, moisture, organic matter and bacteria in the air, (5) temperatures of outer and inner air, (6) meteorological conditions as reported officially.

RESULTS OF PHYSICAL TESTS.

LIGHTING.—The gas supply from daily official tests showed average calorific values of 600 B. T. U., gross, and 540 B. T. U., net. The CO_2 from combustion was determined each day and found to average 0.6 cu. ft. per cu. ft. of gas. The water produced was found, from the calorimeter tests, to average 395 grains per cu. ft. of gas burned. Thus with an average of 4.11 cu. ft. of gas consumed per hour, 2.51 cu. ft. of CO_2 and 1585. grains of H_2O were produced.

The gas lamps threw more light down to the table than did the electric while the latter sent more out toward the walls. The better general room illumination with the electric lamps was very noticeable in reading the test apparatus. This difference in the general character of the illumination is probably sufficient to explain the slight differences in the optical effects disclosed later.

Each electric lamp required an average of 94 watts per hour, the heat equivalent of which is 658 B. T. U. Thus it is seen that the electric lamp gave off about half the heat of the gas burner (1,382 B. T. U.) and that the heat of the former is not incomparable to that of the latter, as has often been stated.

VENTILATION.—Mechanical tests of the actual ventilation were out of the question, and it became necessary to introduce a large quantity of CO_2 into the room, to mix it thoroughly with the air and to determine the reduction at different intervals. At first the air supply was measured before and after each evening's work and an average taken. But as the ventilation data began to accumulate wide variations were evident in spite of all precautions to keep uniform conditions. It was shown that the variation was not related to changes in direction and force of wind; indeed the greatest ventilation was associated with light winds and calm. A close examination of all the data showed later that changes in ventilation were closely

TABLE I.—Ventilation of Test Rooms. Rideal's Study of Hygienic Values of Gas and Electric Lighting.

	Preliminary.	During run.	Final.	CO_2.*
	Cu. ft. per hr.			
UNDIVIDED ROOM.				
(Fireplaces and ventilators closed.)				
Gas evenings.....	2,587	3,579	3,185	29.5
Electric evenings...	2,913	3,492	3,667	22.6
DIVIDED ROOMS.				
(Fireplaces and ventilators closed.)				
Gas evenings	1,335	2,002	2,230	41.1
Electric evenings...	1,425	1,952	2,016	31.1
(Fireplaces and Ventilators open.)				
Gas evenings		5,078		19.4
Electric evenings...		3,748		19.3
(Fireplaces, Ventilators, Windows and Doors Open.)				
Gas evenings		15,000±		8.7
Electric evenings...		17,000±		7.2

*At steady state; parts per 10,000.

*A brief abstract and a review of a paper by Dr. Samuel Rideal, F. I. C., in the Journal of The Royal Sanitary Institute, Vol. XXIX, No. 2, March, 1908.

related to changes in temperature difference between inner and outer air. By computing back from temperatures and values for CO_2 produced and present the intermediate values of Table I. were derived.

From Table I. it seems that the ventilation, purposely restricted though it was, was slightly increased with the gas. This was attributed to strong currents set up by the heated products of combustion. The increase during the run cannot thus be explained as the lamps were lighted while the preliminary figures were being taken. Such increases then were attributed to the occupants themselves, who added twice as much heat as the gas burners and kept the air in motion by their movements and respiration.

The average composition of the whole air space, shown by Table I., was hygienically less important than in the breathing zone. A few determinations of the CO_2 were made at various levels with the results shown in Table II. These indicate that at all levels, except just above the floor, the composition is constant.

Dr. Rideal considered the results of the ventilation studies especially significant on account of the massive construction of the building. For a dwelling of ordinary frame construction far higher figures could be expected.

TEMPERATURE.—There were two general temperature gradients expected: (1) from the ceiling downward and (2) from the walls inward. Vertical and horizontal chains of thermometers were placed to study this effect. The floor temperature was generally some 5° below the room average. The thermometers near the center of the room usually read about 1° higher than at the wall. The investigator's conclusion is that the heated gas and air from the lamps, and from the mouths of the subjects, rose rapidly to the ceiling, spread out to the walls and, losing heat all the time, dropped to the floor.

The temperatures of the room rarely became steady and it was calculated that roughly only 28% of the heat generated was carried away by the changing air, while 72% went by radiation and conduction. Table III. shows a summary of average temperatures for different arrangements of the test rooms.

In spite of individual readings the various thermometers all rose and fell together. There was only a slight rise in average temperature at any time in spite of long runs, crowded rooms and restricted ventilation. On two occasions the lamps were left lighted all night and neither illuminant was able to maintain the evening's temperature by some 4°. This fact agrees with the conclusion that may be drawn from Table IV. that the rise in temperature was due to the human occupants more than to the illuminants.

HUMIDITY.—The term "humidity" has been used relatively, to indicate the ratio between moisture absorbed and true saturation point of the air. Determinations were all made with wet and dry-bulb thermometers in spite of some undesirable features. Absolute determinations were tried but were unsuccessful.

The moisture was artificially increased at times in connection with both gas and electric lighting, but noticeable effects were not produced on the occupants. Dry heat was introduced at another time to reach extreme dryness, but no appreciable effects were produced on the subjects.

ORGANIC MATTER IN AIR.—It is an old contention that the breath throws out unhealthful volatile substances, but many careful experimenters deny this, and claim that chemical changes in air, produced by healthy humans, are not markedly deleterious and that temperature and humidity are the vital factors affecting comfort and susceptability to disease. However, as some ventilation requirements are based on such supposed respiratory products, their determination was attempted. A method was developed in which these substances were oxidized by potassium permanganate (SO_2 evolved with combustion of coal gas shown to be negligible). The following results are gathered directly from Dr. Rideal's report:

The substances increase in an electrically-lighted room in which people are present. Continuous burning of gas for 19 hours (in a room without persons) also gave high and constant values. Thus there are evidently two kinds of organic matter in the air of a gas-lighted room—analogous to the two classes of CO_2.

When the CO_2 reached a stationary value the quantity of "organic substances" did also.

In occupied rooms in which no gas was burning the absorption of oxygen (the oxidization of organic matter) increased by five volumes per million volumes of air. When gas was burned this increase was less, being roughly three volumes per million. The obvious conclusion is that some of the substances are destroyed by the temperature induced in burning gas.

BACTERIA.—During the early investigations upward of 100 bacteriological observations were made to determine a possible reduction of organisms with gas or electric lighting. All determinations were under normal conditions during the medical, chemical and physical experiments.

The average results of exposures in various parts showed a reduction of 29.2% for electric light and 35.3% for gas. The studies showed that the condensation of moisture on cool surfaces helped this decrease. The condensed water collected under electric illumination contained from 9 to 18 organisms per c. c. When gas was burned the condensed water was sterile, which the investigator explains as a result of the germicidal action of the traces of SO_2 condensed also. [It should be remembered that coal gas was used and that the germicidal effect of burning water-gas would probably be much less.—Ed.]

LEAKAGE OF COAL GAS.—Delicate tests showed that on no occasion—unless specially and purposely arranged—was there as much as one part of CO in 1,000,000 parts of air, and then with both systems alike. As CO is the only poisonous constituent of moment in coal gas, and then only some 5 to 8%, it was considered advisable to test the amount of CO in the room air with various amounts of coal gas escaping unburned in imitation of leaks that might be expected to occur in a residence. Three men remained for over four hours in the room while 8.8 cu. ft. of gas per hour was escaping. The smell was very strong, and such a leak in a house would have been immediately detected. No serious or very marked symptoms were manifest in any of the men and the recovery from even these was quick and complete. The inference drawn is that any accidental leakage is not apt to be an immediate menace to health.

RESULTS OF PHYSIOLOGICAL TESTS.—Increased activity of one organ of the body to compensate for decreased activity of another is a well recognized action and it is generally understood that as long as adequate increase is possible by one organ to compensate for decrease in another then good health is maintained. But the working limits of any organ are not to be exceeded and good health is most stable when all parts are working near their mean power, when no one is overloaded. The object of Dr. Rideal's physiological studies was to determine the states of different functional activities under gas and electric lighting and to detect any excessive taxation upon any organ by either illuminant.

CIRCULATORY AND RESPIRATORY SYSTEMS.—The rate of pulse was taken as an indicator of changes in environment. Variable effecting conditions such as age, hour, exertion, fatigue, excitement, depression, etc., were largely eliminated. The pulse rate was found, as a rule, to gradually fall off each hour by about 1.7 beats per minute under both illuminants. This is good evidence that either system has no appreciably different influence on any of the many actions affecting the pulse.

The rapidity of respiration showed an hourly loss in the studies made in the large room of about 0.3 of a period per minute under both lighting systems. When the small rooms were fitted up the drop increased to 0.5 and 0.9 for electric and gas systems, respectively. It is evident then that respiratory changes are due to conditions other than the lighting in itself.

ANIMAL HEAT AND BODY TEMPERATURE.—Functional activity and rate of chemical action vary in different parts of the body and under different out[door] conditions, but the heat liberated is always more than [enough] to maintain normal body temperature (98.4° F.). The excess is caused to disappear through radiation [and] evaporation of water from lungs and skin. Co[ntrol] of body temperature is controlled by the nervous [sys]tem, hence an abnormal change in temperature is an [indi]cation of a disturbance of natural nerve function. The normal average maximum comes late in the [after]noon with a gradual decline until late at night. Under these tests slightly excessive decline in temperature was expected and only when the average drop under one light was different from that under the other light would a different influence be shown. Under gas light the average fall during the evening was 0.9° F. and with electric, 0.8°, a difference so small as to be meaningless.

BODY WEIGHT.—All during these studies the men were properly weighed at the beginning and end of each evening's work. Under both systems the average losses per man per hour were very close to 0.3 lb. throughout the experiments, showing no appreciably different effects.

MENTAL FATIGUE.—This term is used to denote a state in which one does mental work less accurately and slower than normally although working well within one's power to do such tasks. Problems in addition were set, at the beginning and end of several evening's sessions, to ten subjects usually. Increase in time required and in errors made were rated as losses and decrease in time and errors, as gains. The results of this study showed some losses, more gain and a few stationary values. On the whole a general improvement was seen, due probably to the period of rest. The greatest improvement in speed was under electric light and the greatest in accuracy was under gas.

IMPRESSION ON THE SENSES.—As it is often claimed that olefactory perception is more sensitive than the most delicate chemical tests, it was thought that there might be so found some differences, attributable to the system used, which had not come out from previous tests. It had been already found that chemical tests for CO recorded values before any smell of coal gas was perceptible. On five occasions tests were made with nine observers. A closed room was used in which gas or electric lamps had been in use from 3 to 12 hours previous. When the subjects were asked to judge which had been used both systems were running. Each man snuffed the air through his nose, inhaled it through his mouth and endeavored to detect a change between the room air and that outside that would show gas to have been burned. Fifteen opinions were "doubtful," eight correct ones for gas and two for electricity were given.

OPHTHALMIC WORK.—It was necessary to limit studies of the direct effect on the eye to fatigue tests. Nearly a thousand observations were made in the following classes: (1) visual acuity by test types at six meters distance; (2) power of co-ordinating the vision of each eye by overcoming the effect of prisms; (3) "punctum proximum," or nearest point on which the eyes could be focused; (4) power of light perception of the

TABLE III.—AVERAGE TEMPERATURE IN TEST ROOMS DURING COMPARISON OF GAS AND ELECTRIC LIGHTING (Degrees Fahrenheit).

	Gas.			Electric.		
(Fireplaces and ventilators closed.)	Initial.	Final.	Rise.	Initial.	Final.	Rise.
Undivided room	53.6	57.0	3.4	54.0	57.2	3.2
Divided Rooms	59.0	63.4	4.4	58.7	62.9	4.2
(Fireplaces and ventilators open.)						
Divided Rooms	60.8	63.9	3.1	59.2	62.7	3.5
(Fireplaces, ventilators, doors and windows open.)						
Divided rooms	58.4	57.5	—0.9	58.3	56.9	—1.4

TABLE II.—DISTRIBUTION OF CO_2 AT DIFFERENT LEVELS IN TEST ROOM. RIDEAL'S EXPERIMENTS. (Parts in 10,000.)

Height above floor	9 ft., 10 ins.	8 ft.	4 ft., 3 ins.	6 ins.
Distance below ceiling	6 ins.	2 ft., 4 ins.	6 ft., 1 in.	9 ft., 10 ins.
Aberage CO_2	28.4	27.5	26.8	21.9
Ratio to average of whole room	1.09	1.05	1.03	0.83

TABLE IV.—RELATIVE PRODUCTION OF HEAT, MOISTURE AND CO_2 BY MEN AND BY GAS AND ELECTRIC LAMPS.

Hourly production of	Two 25-cp. Electric Lamps.	Two 25-cp. Gas Lamps	Six Men.
B. T. U.	658	1,382	2,040
Grains water	—	1,012	4,200
Cu. ft. CO_2	—	1.54	4.8
This would cause temp. rise	13.9°F	29.1°	42°
Final humidity	43%	31%	31%
Added CO_2 (points in 10,000)	——	6.2	19.2
Final CO_2	4	10.2	23.2

TABLE V.—HUMIDITY DEVELOPED UNDER GAS AND ELECTRIC LIGHTING. RIDEAL'S EXPERIMENTS.

	Gas.	Electric.
UNDIVIDED ROOM.		
Outer air	78.	77.
Room air, initial	73.9	72.7
Room air, final	76.6	75.4
Change	+2.7	+2.7
DIVIDED ROOM (Restricted Ventilation).		
Outer air	76.6	76.6
Room air, initial	70.1	71.4
Room air, final	72.9	73.6
Change	+2.8	+2.2
(Fireplaces and Ventilators Open.)		
Outer air	74.5	74.5
Room air, initial	69.5	71.0
Room air, final	70.0	70.5
Change	+0.5	—0.5
(Doors and Windows Open Also.)		
Outer air	75.5	75.5
Room air, initial	65.0	69.0
Room air, final	66.0	68.0
Change	+1.0	+2.0

retina by ... number of opal glasses through which a standard ... le could be distinguished at one meter's distance. ... se tests were usually made at the beginning of the ev... g and after three hours. The acuity of vision, th... power of co-ordinating the eyes, the accommodat... to distance and the retinal perception were all slightl... more decreased under electric lamps than under gas.

A LAKE FRONT HARBOR PROJECT FOR CHICAGO.

The ha... or problem of Chicago was discussed at some ... ength in our issues of Aug. 16, 1906, and Jan. ..., 1908. In the latter issue we referred to the ap...pointment by the Mayor of a special commis...n to consider this problem in all its various ...pects. A number of opinions and projects ha... been submitted to the commission by various persons and associations. At a recent meeting of this Harbor Commission a paper reviewing the conditions and suggesting a remedy was read by Mr. W. H. Johnson, Western Agent for the Anchor Line of lake steamers.

It was claimed that the city is losing its share of the package-freight and general freight traffic through its lack of harbor and warehouse facilities. While the larger steamers can now pass through the river, since the removal of the three street-railway tunnels, this river navigation is extremely expensive. This is due to the loss of time (owing to slow movement and numerous bridges) and to the necessity for using tugs. The bills for tug service were said to average $250 for a trip with a large steamer in the Chicago River. In Mr. Johnson's opinion it would be necessary to make the river 300 ft. wide to enable large vessels to lie at wharves on each side and still leave room for vessels to pass each other in the stream. This, he considered, would be impracticable. The narrow river, with its numerous bridges, makes the expense of getting to and from the docks very much higher than at other ports. The steamship lines, therefore, prefer such other ports. In addition to this, the Chicago River docks and terminals are in the congested district of the city where land values are already high and are increasing. To go farther up the river to new terminals at outlying districts would increase the time of steamship trips materially.

Mr. Johnson stated that the freight business on the lakes is handled by eight steamship lines, owned or controlled by the eastern trunk-line railways. Their fleets aggregate 54 steamers, and could carry annually 4,000,000 tons into Chicago and take an equal tonnage out of the city. Under present conditions, the fleet handles only about 2,250,000 tons of grain and package freight in and out of Chicago each season. In fact, it has been asserted that shippers object to route lake-and-rail traffic through Chicago if they have outlets through other ports, and it is said to take six days longer to get such freight through the Chicago gateway than through any other lake port. The distribution of anthracite coal for the west is done mainly through Milwaukee and Duluth, and Chicago holds its grain traffic largely by the influence of important local interests.

An outer or lake-front harbor was advocated by Mr. Johnson. There is already a tendency to handle much of the freight by lighters, and this could be done as readily from a lake-front harbor as from an inland harbor. Much of the lighterage business can be carried on without being affected by the bridges.

The location of the proposed lake-front harbor is immediately north of the mouth of the river, extending to the south end of Lincoln Park. The United States breakwater extends diagonally opposite this part of the shore. A pier from Lincoln Park to the north end of the breakwater, and the extension of the north pier at the north side of the river mouth eastward to the south end of the breakwater would form a large enclosed harbor. Suitable openings would be provided. Piers 2,400 ft. long would be built out from the shore line into the harbor, with slips 280 ft. wide between the piers. The piers would be about 260 ft. wide, each having a 100-ft. roadway and two rows of 80-ft. warehouses. There would be five of these piers to accommodate the different classes of traffic.

Railway lines already extend to the mouth of the river and could be connected with the harbor terminals without difficulty. The Chicago & Northwestern Ry. has a freight line along the north side. The Illinois Central Ry. has a freight yard at the extereme end of the river on the south side, and for years has had a drawbridge for connection with the north side of the river. Through these two railways, with their numerous connections and the different belt lines, there would be good facilities for distributing freight throughout the city or passing it around the city to or from the main freight yards of the several railways which center at Chicago.

REPORT OF C. C. SCHNEIDER ON THE DESIGN FOR THE QUEBEC BRIDGE.

During the investigation of the collapse of the Quebec Bridge by a commission of engineers for the Canadian Government, a very important associated investigation was entrusted by the Government to Mr. C. C. Schneider, Past-President Am. Soc. C. E. This had the purpose of determining the sufficiency of the design for the bridge, as it was being executed. Mr. Schneider concluded his report six months ago, but it has only now become available to us, having been published jointly with the report of the Royal Commission by order of the Parliament of Canada.

The report contains many statements and judgments of great interest. For the present, however, we are confined to a statement of the specific conclusions which summarize the report and answer the terms of the author's instructions:

1. The floor system and bracing are of sufficient strength to safely carry the traffic for which they were intended.
2. The trusses, as shown in the design submitted to the writer, do not conform to the requirements of the approved specifications, and are inadequate to carry the traffic or loads specified.
3. The latticing of many of the compression members is not in proportion to the sections of the members which they connect.
4. The trusses of the bridge, even if they had been designed in accordance with the approved specifications, would not be of sufficient strength in all their parts to safely sustain the loads provided for in the specifications.
5. It is impracticable to use the fabricated material now on hand in the reconstruction of the bridge.
6. The present design is not well adapted to a structure of the magnitude of the Quebec Bridge and should, therefore, be discarded and a different design adopted for the new bridge, retaining only the length of the spans in order to use the present piers.
7. The writer considers the present piers strong enough to carry a heavier structure, assuming that the bearing capacity of the foundations is sufficient to sustain the increased pressure.

TWO INTERURBAN CARS of the Detroit United Railways met in a head-on collision July 24 near a switch 1½ miles east of Jackson, Mich. The forward end of one car was demolished, and one person was fatally injured. The accident is ascribed to the failure of the brakes to work on one of the cars.

A HEAD-ON COLLISION between two cars of the Aurora, Elgin & Chicago Interurban R. R. took place near Aurora, Ill., July 21. The wreck is attributed to the failure of one of the motormen to obey orders. The cars were running at 40 mi. per hr. and were telescoped for more than half their length. Although part of a third-rail system, that portion of the road where the accident occurred is equipped with an overhead trolley, from which the cars caught fire. Although some 40 persons were reported as injured no deaths occurred at the time of the accident.

A DITCH WALL CAVED IN at the Grace Ave. sewer excavation in Youngstown, Ohio, July 15, killing four workmen. The bank caved first at the bottom.

THE PREMATURE EXPLOSION of a 25-lb. charge of dynamite, July 21, at the 16-ft. cut which is being made on the Cumberland Valley R. R. west of Shippensburg, Pa., resulted in the death of three workmen.

AN INRUSH OF WATER in the heading of the north end of the Loetschberg Tunnel drowned 25 workmen on July 24. During recent months the flow of water in the north end has been increasing rapidly, though at last reports it had not reached such a volume as to hamper the tunneling work. Apparently, however, it indicated that the face was approaching large subterranean water passages or pockets. From the press reports the accident does not appear to have occurred during a blast, but the water is said to have forced out a section of rock without warning. All work on the north end was stopped by the accident.

THE DEPARTMENT OF MINES of British Columbia reports the number of accidents in coal mines for two years past as follows:

	Number.		Per 1,000 Emp.	
	1906.	1907.	1906.	1907.
Killed	15	31	3.12	5.12
Seriously injured	36	61	7.49	10.07
Slightly injured	32	62	6.66	10.23
Total	83	154	17.27	25.42

The increase in the number killed and injured last year was large; 85.5% in number and 47.2% in proportion per 1,000 employees. Falls of coal and rock were responsible for 32.3% of the deaths, and 30.3% of the injuries. In ten years there have been 413 employees killed and 656 injured in British Columbia collieries.

THE DEEP WATER HARBOR of Gary, the new steel town of Indiana, was formally opened July 23, when there was received the first big shipment of iron ore. The "E. H. Gary" entered the harbor loaded with 12,000 tons of iron ore from the Lake Superior deposits. This ore will be manufactured into steel in the Gary mills.

THE APARTMENT HOUSE COLLAPSE IN WASHington, D. C., on June 9, 1908 (Eng. News, June 18, p. 678; June 25, p. 693), has just been acted upon by the grand jury with the result that the owner and the contractor for the concrete work have been indicted for manslaughter under the charge of criminal negligence. It will be remembered that the coroner's jury brought in charges of negligence against the owner, the city's inspector of buildings, the steel contractor and the brick contractor. All but the first of these charges were ignored by the grand jury which, as noted above, added to the list the concrete contractor, a man who is now awaiting a second trial, after a jury which disagreed on the first trial, for criminal negligence in connection with the concrete work on the Bridgman Building in Philadelphia, which collapsed about a year ago (Eng. News, July 18, 1907, p. 69). The indictment charges the concrete contractor with using poor materials in the concrete and with a lack of care in construction; the owner was indicted because he did not exercise or cause to be exercised a competent supervision over the actions of the contractors. In addition to the indictment the jury made the following recommendations:

(1) That the office of the inspector of buildings is now inadequately equipped for the important duties required, in that the number of employees (especially field inspectors) is too small to permit thorough inspection of the large number of buildings being erected, and the salaries paid to both field and office employees are entirely inadequate to command the necessary technical and practical ability.
(2) That as this office of building inspector is of vital importance to the interests of the public, the greatest discretion should be exercised in the selection of its employees.
(3) That some method should be adopted to insure the designing and execution of building work, especially the structural parts, by none but those fully competent.
(4) That prosecutions should follow serious violations of the building regulations whenever and wherever discovered whether accidents have resulted or not, the jury believing that with competent inspection such violations would be detected.
(5) That some requirement for proper superintendence at the expense of the owner should be adopted in the case of important structures.

THE WATER GATE TO TAMPA, Fla., has been opened by the completion of the channel through Hillsborough Bay, making Tampa one of the Atlantic ports. Direct service from New York to Tampa has been inaugurated by the Mallory Line.

FIRE HAZARD OF INCANDESCENT LAMPS.—For the proper safeguarding of life and property the National Electrical Code prescribes that no live parts of an incandescent lamp base shall be exposed when the lamp is in the socket. Underwriters' Laboratories and manufacturers of sockets, receptacles and incandescent lamps have cooperated for several years for the establishment of standards, whereby this result has been accomplished for the bases of common, carbon-filament lamps. The new high-efficiency lamps, such as the Tantalum and Tungsten, require a metal extension or "skirt" over the bulb beyond the Edison screw base. Designs have been developed and adopted by American manufacturers for constructing these high efficiency lamps in such a manner as to insulate this skirt from current-carrying parts of the base and so secure in these types the same degree of protection as that already obtained for the older patterns. Some foreign manufacturers are, however, supplying lamps having exposed skirts not insulated from the circuit. Attention is called to the desirability of giving preference to lamps having no live metal parts exposed when placed in the standard socket, which has a depth

of 15/16-in. in a vertical plane from the bottom of the center contact to the upper edge of the outer socket shell or wall.—(Special Bulletin, Underwriters' Laboratories of Chicago, July, 1908.)

THE NORTH BRANCH OF THE CHICAGO DRAINage Canal is now under construction, and the Sanitary District will itself undertake the disposal of the excavated material. The contractors have not to remove the material, but deposit it along the line of the canal. As this material is largely soft earth and black loam, it is adapted for filling at parks and gardens, and it can be removed readily by barges when the channel is completed. The material from one section of the work has already been sold to a contractor at 5 cts. per cu. yd. Part of the clay will be removed by the South Park Commission for use in filling the extension to Lincoln Park. This branch of the canal will be 8¼ miles in length, from the lake shore at a point about ½-mile north of Evanston to the north branch of the Chicago River at Lawrence Ave., where the conduit of the intercepting sewer system also enters the river. The canal will be 75 ft. wide at the water line, with water 13½ ft. deep. The total amount of excavation will be about 3,000,000 cu. yds., of which 137,000 cu. yds. are loam.

The excavation for the first two miles at the north end of the canal is being done by the Construction Department of the Sanitary District. All this material is hauled away in cars and dumped off the shore of Lake Michigan at Wilmette, where a harbor is to be formed. A section of 1¼ miles is under contract. The material from this part will be deposited in spoil banks along the canal, and a large part of it will be removed eventually by contract with a brick company. On the remaining five miles there is still some right-of-way to be purchased. Mr. L. K. Sherman, Assistant Engineer, is in charge of the work on the North Shore branch.

AN INVESTIGATION OF THE SPREAD OF TYPHOID fever by contact is to be made in Washington, D. C., according to press reports, by the U. S. Public Health and Marine-Hospital Service, and Dr. William C. Woodward, Health Officer of the District of Columbia. A number of blocks have been selected for the purpose, and it is reported that in this section a house-to-house inspection will be made. Presumably the investigation will be broader than indicated above, so that it will really cover all phases of the origin and spread of the disease in the section investigated.

THE COLORADO RIVER WATER SYSTEM is to receive international attention. According to the "Reclamation Record" for July,—

The Mexican Government has appointed Senor Fernando Beltian y Puga, Chief of the Mexican Boundary Commission, to act with Supervising Engineer Louis C. Hill, U. S. Reclamation Service, appointed by the United States, for the purpose of studying questions in connection with the equitable distribution of the waters of Colorado River. The Commission will report the nature and character of the use of Mexican territory necessary or advisable for protection of the Laguna Dam; the equitable adjustment of existing rights to the diversion of the waters of the Colorado River for irrigation in both countries. The determinations made by the Commission on these questions, while not binding upon either government, will be of assistance in forming a basis of agreement for the mutually beneficial use of the water of the Colorado River.

THE COST OF PAINTING THREE WOODEN bridges on the South Canal of the Uncompahgre Project, U. S. Reclamation Service, is summarized in the July number of the "Reclamation Record" as follows:

The painting was done during the months of December, 1907, and January, 1908, when the weather was quite cold. Two of the bridges consist of four 13-ft. stringer spans, and one 40-ft. span queen post truss, and the other consists of four 15-ft. stringer spans and one 30-ft. span king post truss. The latter bridge and one of the former were constructed of Oregon fir lumber surfaced on both sides, while the other was constructed of rough native pine lumber.

The painting consisted of two coats of white lead mixed with linseed oil and shellac. The cost of the first coat in each case was practically twice that of the second coat. The average cost per hundred square feet for the surfaced lumber was $1.61, requiring 3 lbs. of pure white lead and 0.45 gal. of raw linseed oil. The cost per 100 sq. ft. of surface for the rough lumber was $3.49, requiring 14.8 lbs. of pure white lead and 1.6 gals. of raw linseed oil. The lead cost 8½ cts. per lb. on the work and the linseed oil 55 cts. per gal.

THE DIRTIEST RIVER IN THE UNITED STATES, according to a press bulletin of the U. S. Geological Survey, is the Youghiogheny. Writing of examinations of that stream conducted by the Survey during the past two years, the bulletin says:

In this stream the average quantity of dissolved mineral matter is 1.28 lbs. per 1,000 gals., or 619,000 tons a year, and of suspended matter 2.12 lbs. per 1,000 gals., or 1,028,000 tons a year. For each acre of tributary drainage area, therefore, the stream carries past McKeesport every day 7.97 lbs. of material, or about 75% more than any other stream examined. Over two-thirds of this material, however, is doubtless derived from the mills and factories that line its banks for the last few miles of its course. The quantity of this foreign material varies greatly from day to day. Thus the extreme variation in suspended matter is 6.27 times the average amount and the variation in dissolved matter is 2.10 times the average amount.

The dissolved mineral matter is composed of the following ions: Silica, 4.9%; iron, 0.12%; calcium, 13.7%; magnesium, 3.8%; sodium and potassium, 3.9%; sulphate, 71.5%; and chlorine, 2.1%. So much acid is thrown into the stream from the pickling wastes of iron and galvanizing works that free acid is found in the water except during flood stages. The conditions combine to render the stream at McKeesport unsuitable for many industrial purposes. Treatment by the usual softening processes will greatly improve the quality of the water.

MUNICIPAL OWNERSHIP AT PORT ARTHUR, ONT., now includes water-works, electric lights, an electric railway running to Fort William, a hydro-electric power development, and a telephone system. The city issues an annual statement of the income and expenditure of public franchises. Mr. George Hodder is chairman of the various departments operating these utilities, and Mr. J. McTeigue is secretary of the Electric Railway and Light Commissioners.

THE HAUSER LAKE POWER DEVELOPMENTS will be carried out by the Stone & Webster Engineering Corporation, of Boston. This arrangement, it is announced, has been completed by Senator Clark, ex-Governor Hauser and Mr. H. H. Rogers, representing the Missouri River Power Co. This projected development of power resources on the upper Missouri River, in Montana, will be the largest undertaken since the beginning of the recent industrial depression. The entire construction planned will cost about $3,000,000 and will be done in two stages. The first of these will be the building of a concrete dam to permit the development of 20,000 HP. and to replace the Hauser Lake steel dam whose failure was described in Engineering News, issue of April 30. This work will be started immediately. The second division of the development will include a concrete dam about 1,800 ft. long and 110 ft. high, to allow a 30,000-HP. development at Wolf Creek on the Missouri River, a few miles above the Hauser Lake reservoir.

HARBOR DEVELOPMENT IN SAN FRANCISCO has been studied during the past two years by a strong association of interests concerned in improving the shipping facilities of the city, with Mr. Luther Wagoner, M. Am. Soc. C. E., as Chief Engineer. As a result of the studies a report has been made which recommends a very extensive development, the work being estimated to cost nearly fifty million dollars. Part of the project is the construction of a large marine terminal for railways on Yerba Buena Island. It is likely that state, local and federal cooperation will be required to carry the project through to realization.

A COTTON-PICKING MACHINE has been devised, on lines similar to the vacuum-process cleaning machines, by Mr. J. S. Thurman. The machine is being built by the Vacuum Cotton Picking Machine Co., of St. Louis, Mo., in four sizes for two, four, six and eight pickers. The vacuum-producing apparatus, driven by a gasoline engine, is mounted on a wide-wheel truck which is drawn about the cotton field by mules. Each operator has 100 ft. of hose with the picker suction-tip at the end. It is claimed that each operator can gather 700 lbs. of seed cotton per day of ten hours, at a total cost of from $2.45 to $3.10 per operation per day.

IMPROVEMENTS IN THE STEEL INDUSTRY are indicated by a statement made on behalf of the U. S. Steel Corporation on July 23, by Mr. William B. Dixon, Second Vice-President. After a meeting of the leading officials of the associated companies, Mr. Dixon stated that the reports received "were uniformly favorable, showing a great increase in business in practically all lines." He also said that about 50% of the finishing capacity of the various plants was now in operation. Since the date of this statement, press despatches from Pennsylvania have recorded the opening of several furnaces.

THE INTERSTATE COMMERCE COMMISSION has rendered an important decision in a group of cases involving the right of shippers to combine small quantities of freight of various ownership, either by mutual agreement or through some forwarding agency, and to ship the combined lot at the lower rates applicable to large shipments. The question was decided in favor of the shippers on the ground that the fact that one shipper tenders a bulked shipment made up of property of various ownership does not justify discrimination between that shipper and one who is also the owner. The commission holds that the rules of the express and railway companies against "bulked shipments" are illegal.

PERSONALS.

Mr. F. C. Smith, Assistant General Manager of the San Antonio & Aransas Pass Ry., has resigned to engage in other business.

Capt. Albert E. Waldron, Corps of Engineers, has been appointed Chief Engineer Officer of the Department of Texas, relieving Capt. William P. Wooten.

Mr. E. H. Smith, formerly Division Master Mechanic of the Boston & Albany R. R. at Allston, Mass., has been appointed railroad representative of the American Steam Gage & Valve Mfg. Co.

Major E. L. Zalinsky, U. S. A., Retired, has become President of the Bureau of Illuminating Engineering, a corporation of consulting illuminating engineers. His office is at 437 Fifth Ave., New York City.

Mr. D. I. Roberts, formerly General Freight and Passenger Agent of the Quebec, Montreal & Southern Ry., has been appointed General Manager of that road, to take the place of Mr. C. B. Hibbard, resigned.

Mr. Will M. Dixon, M. Am. Inst. E. E., and Howard F. Smith, Mechanical Engineer of the Louisiana Purchase Exposition, will conduct a general engineering business under the firm name of Dixon & Smith, Engineers. Their office will be in the Wright Building, St. Louis, Mo.

Mr. G. I. Rockwood, M. Am. Soc. M. E., Professor of Steam Engineering at Worcester Polytechnic Institute for the past two years, has resigned that position. He will be succeeded by Mr. Carleton A. Read, M. Am. Soc. M. E., recently Professor of Mechanical Engineering at New Hampshire College.

Obituary.

John D. Ingrim, for ten years Superintendent of the Jeffersonville branch of the American Car & Foundry Co., died July 25 in Louisville, Ky. His death occurred in the Norton Infirmary and was caused by an attack of pneumonia following an operation for appendicitis. Mr. Ingrim was born in Jeffersonville, Ind., in 1855, and was the son of Col. J. N. Ingrim. He began as a mail boy in the car shops and worked his way to the top. He was not married.

Mr. I. K. Pierson, a civil engineer of Cleveland, O., was killed near Puerto Cortez, Honduras, July 24 by a fall from a horse. Mr. Pierson had a contract on the Panama Canal under the De Lesseps regime and since then had been engaged in electric and steam railway construction in the United States and Canada. He went to Honduras three weeks before his death to take charge of improvements planned by the Caribbean Development Co., of New York City. Mr. Pierson was 52 years old.

ENGINEERING SOCIETIES.

COMING MEETINGS.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 23-25. Annual convention at Atlantic City, N. J. Secy., Willard Kent, 715 Tremont Temple, Boston, Mass.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Sept. 29. Annual meeting at Birmingham, Ala. Secy., R. W. Raymond, 29 West 39th St., New York City.

LEAGUE OF AMERICAN MUNICIPALITIES.
Sept. 30-Oct. 2. Annual convention at Omaha, Neb. Secy., John MacVicar, Des Moines, Iowa.

ILLUMINATING ENGINEERING SOCIETY.
Oct. 6-7. Annual convention at Philadelphia, Pa. Secy., Van Rensselaer Lansingh, Engineering Societies' Building, 33 West 39th St., New York City.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., B. V. Swenson, 29 West 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Oct. 13-15. Annual meeting at Washington, D. C. Secy., C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 20-22. Annual convention at Washington, D. C. Secy., R. H. Reid, Lake Shore & Mich. Southern Ry., Cleveland, Ohio.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

NATIONAL IRRIGATION CONGRESS.—The sixteenth session will be held Sept. 29-Oct. 3 in Albuquerque, N. Mex. Men prominent in national affairs, including the president, vice-president, cabinet members, senators, congressmen and governors from many of the southwestern states are expected to address the congress. Delegates are appointed by the governors of each state or territory, mayors of cities, boards of supervisors, state promotion associations, irrigation societies, agricultural organizations, colleges and universities and societies of hydraulic engineers throughout the United States.

INTERNATIONAL ACETYLENE ASSOCIATION.—The eleventh annual meeting will be held Aug. 10-12 at Chicago, Ill. Papers will be presented on the following topics: "Burner Troubles, the Cause and the Remedy"; "History of Lava in Relation to the Manufacture of Burners"; "Ethics of Selling Goods"; "Acetylene on the Pacific Coast"; "The History and Present Status of the Oxy-Acetylene Blowpipe in America"; "The Value of Co-operation between Industries and the Underwriter"; "Personal Experience with Artificial Illuminants"; "The Manufacture of Acetylene Fixtures"; "Frost Proof Generator Houses"; "Calcium Carbide in New Fields"; "Light and Color"; "The Present and Future of Dissolved Acetylene"; "Some Industrial Uses and Possibilities of Acetylene."

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, July 30, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(denotes that this work is advertised in Engineering News.)*

The following Plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

Bids close.	Work.	Place.	See issue.
8- 1	Marine Ry., Key West, Fla...	(S.)	7- 2
8- 1	Coal-handling plant, N. Y. ..	(S.)	7- 9
8- 1	Retaining wall, etc.,	Phila... (S.)	7- 9
8- 3	Bridge,	Benton, Tenn.... (P. & S.)	7-16
8- 3	Water pipe, Fort Wood, N. Y. (P. & S.)		7-16
8- 4	Water system, Bremerton, Wash. (S.)		7- 9
8-14	Reservoir,	Lincoln, Neb..(P. & S.)	7-30
8-15	Boilers,	Philadelphia, Pa.....(S.)	7-30
8-19	Pumping plant, equipment, Jerseyville, Ill.	.....(P. & S.)	7-23
8-27	Dam, etc.,	Orland, Cal.....(S.)	6-11

LIST OF CONTRACTS PENDING.

LIGHT, HEAT AND POWER PLANTS.

7-30 'Phone material, Regina, Sask.... 7-30
7-31 Repairing engines, etc., New York. 7-23
8- 1 Power plant, Townsend, Mont.... 6-11
8- 3 Light plant, Hamilton, Ont..... 7-23
8- 3 Carbons Victoria, B. C..... 7-30
8- 4 Incandescent elec. lamps, Washington, D. C..... 7-30
8- 5*Lighting, Cranford, N. J..... 7-16
8- 7 Power plant, Hartford, Wis.... 7-30
8-25*Power-house equipment, etc., Port Washington, Wis..... 7-30
8-26*Power-houses, Wheeling, W. Va.. 7-30
9-14 Lighting streets, Hartford, Conn. 7-30
9-15 Elec. light plant, Winnipeg, Man. 7-30

BRIDGES.

7-31*Bridge, Cincinnati, Ohio 7-16
8- 1 Bridge, Centerville, Pa..... 7-23
8- 1 Bridge, Medina, Ohio..... 7-30
8- 1 Bridge, Menasha, Wis. 7-30
8- 1 Bridge, Terre Haute, Ind..... 7-30
8- 3 Bridges, Rochester, Ind..... 7-30
8- 3 Bridges, Lebanon, Ind..... 7-30
8- 3 Bridge, Newton, Kan..... 7-23
8- 3 Bridge, Delphos, Ohio..... 7-16
8- 3*Bridges, Benton, Tenn..... 7-16
8- 3 Bridge, Granite, Okla 7- 2
8- 4 Bridge, Marion, Ind 7-23
8- 4 Bridges, Tampa, Fla..... 7-30
8- 4 Bridge, Lancaster, Pa..... 7-30
8- 5 Substructure, Uniontown, Kan.... 7-30
8- 5 Culverts, etc., Richfield, Utah.... 7-23
8- 6 Substructures, Eaton, Ohio..... 7-23
8- 6 Bridge, Bethlehem, Pa..... 7-30
8- 7 Bridge, North Vancouver, B. C.... 7-30
8- 8 Bridge, Cleveland, Ohio..... 7-23
8- 8*Bridge, Aurora, Ill. 7-30
8-10 Superstructure, Jefferson, Ohio... 7-23
8-10 Bridges, Newport, Ind..... 7-30
8-12 Bridge, San Antonio, Tex..... 7-30
8-12 Bridge, St. Joseph, Mich..... 7-23
8-12*Bridge, Rye, N. Y. 7-30
8-13*Substructure, etc., Douglas, Ga.. 7-23
8-13 Bridge extension, Hobart, Okla.. 7-30
8-18*Bridge, Sailsbury, Md. 7-30
8-19 Bridge work, etc., Cleveland, O.. 7-30
8-22*Bridge, Rocky River, Ohio..... 7-23
8-31*Bridge, Cuba (U. S. Possess.).... 7-30
9- 2*Bridge equip., Chicago, Ill. 7-30

BUILDINGS.

7-31 School building, New Augusta, Ind 7-23
8- 1 School-house, Sidney, Iowa..... 7-23
8- 1 Plans, St. Paul, Minn. 4-30
8- 1 Plans, Wilkinsburg, Pa..... 7-16
8- 1 Hospital alterations, Cape Cottage, Me..... 7-30
8- 3 School, Huntington, N. Y..... 7-30
8- 3 Fireproof stairs, New York, N. Y. 7-30
8- 3 Boiler room, boiler, Elmira, N. Y. 7-30
8- 3 School, Orange, N. J..... 7-30
8- 3*Building, etc., Batavia, N. Y..... 7-23
8- 3 School work, Brooklyn, N. Y.... 7-23
8- 4 Remodeling, etc., Oskaloosa, Iowa 7-23
8- 4 Mortuary chapel, Rochester, N. Y. 7-30
8- 4 Prison alterations, Brooklyn, N.Y. 7-30
8- 4 Fire house, New York..... 7-30
8- 5 Hall of Records repairs, N. Y... 7-30
8- 5 Court-house, El Dorado, Kan..... 7-23
8- 6 Quarters, Washington, D. C..... 7-23
8- 6*Dwellings, etc., Riverton, Ala..... 7- 9
8- 8 Plans, Kingston, R. I..... 7-23
8- 8 Cottages, Hudson, N. Y..... 7-30
8-10 Church, St. Paul, Minn..... 7-30
8-10 Building, Rome, N. Y..... 7-30
8-10*Post-office, etc., San Francisco, Cal 7- 2
8-10 Refrigerating plant, Rochester, N. Y. .....(Mfg. Pl.) 7-30
8-11*Post-office, Bedford, Ind. 7- 9
8-11 Bldg. addition, Albion, N. Y..... 7-30
8-12*Boilers, Poughkeepsie, N. Y..... 7-30
8-12 Post-office, Anderson, S. C..... 7- 2
8-15 Hospital, Boise, Idaho..... 7-30
8-15 Building, New York, N. Y..... 7-23
8-17 Building, Grand Rapids, Minn.... 7-30
8-19 Armory, Ionia, Mich..... 7-30
8-19 Armory, Pontiac, Mich..... 7-30
8-19*Post-office, Petersburg, Va 7-16
8-20 Hospital, Pittsburg, Pa..... 7-23
8-24*Post-office, Logan, Utah..... 7-16
8-27*Hospital repairs, Ft. Hancock, N. J..... 7-30
8-31 Post-office extension, Little Rock, Ark..... 7-23
9- 1 School plans, St. Paul, Minn. 7- 9
9- 1 Post-office, Greenville, Ohio..... 7-23
9-22 Laboratory, etc., Ann Arbor, Mich. 7-23
9-23 Court-house, Green Bay, Wis.... 6-18

WATER-WORKS.

7-30 Water mains, Jamestown, N. Dak. 7-30
7-31 Water-works, Janesville, Wis.... 7-23
7-31 Pipe line, New York, N. Y..... 7-23
8- 1 Dam, Springfield, Ill..... 7-23
8- 1*Specials, Washington, D. C..... 7-16
8- 1*Water main, Briarcliff Manor, N. Y..... 7-30
8- 1 Water supply, Seattle, Wash..... 7-30
8- 3 Water pipe, Ft. Wood, N. Y..... 7-16
8- 3*Filters, etc., Pittsburg, Pa..... 7-23
8- 3 Water main, Terre Haute, Ind... 7-30
8- 3 Well, Yonkers, N. Y..... 7-30
8- 3 Reservoir repair, Cohoes, N. Y.. 7-30
8- 3 Water-works, Cheyenne, Wyo.... 7-30
8- 3 Water main, Fargo, N. Dak..... 7-30
8- 3 Mains, Lakewood, Ohio..... 7-30
8- 3 Well, Harrisonburg, La..... 7-30
8- 4 Water tank, Pensacola, Fla..... 7-30
8- 4 Water system, Bremerton, Wash. 7- 9
8- 5 Filter beds, Pittsburg, Pa..... 7-23
8- 5 Pipe work, Leavenworth, Kan.... 7-30
8- 7 Water-works, Weston, Neb..... 7-30
8-12*Pumping engine, Trenton, N. J.. 7-23
8-12 Pumping equip., New York 7-30
8-13*Filter plant, Danville, Pa..... 7-16
8-14*Reservoir, Lincoln, Neb..... 7-30
8-14*Water-works, De Funiak Springs, Fla. 7-30
8-15*Chimney, Dallas, Tex..... 7-30
8-15 Boilers, Philadelphia, Pa..... 7-30
8-17*Pipe, Yonkers, N. Y. 7-30
8-18 Conduit system, Green Bay, Wis.. 7-23
8-19*Pumping plant, equipment, Jerseyville, Ill. 7-23
8-27 Dam, Orland, Cal. 6-11
9- 1 Water plant, Russelville, Ala. .. 7-23
9- 1*Concrete conduit, New York, N.Y. 7-30

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7-31 Sewers, Rutherford, N. J..... 7-23
7-31*Sewer, Boston, Mass. 7- 9
8- 3 Sewer, Flint, Mich..... 7-30
8- 3 Sewer, Lakewood, Ohio..... 7-30
8- 3 Sewer, Yonkers, N. Y..... 7-16
8- 3*Sewers, Webb City, Mo..... 7-23
8- 3*Sewer, Sayre, Pa..... 7-23
8- 3 Sewer system, Boonville, Ind..... 7-23
8- 4 Sewers, Bronxville, N. Y..... 7-30
8- 5 Sewer, Sheffield, Ala..... 7-30
8- 5 Storm sewer, Oakland, Cal..... 7-30
8- 5 Sewers, Brooklyn, N. Y..... 7-23
8- 6 Sewer, Miami, Fla..... 7-30
8- 7*Sewer, Springfield, Ohio..... 7-30
8- 8 Sewer system, Toccoa, Ga..... 7-23
8-10 Sewer, Larned, Kan..... 7-30
8-11 Sewer, Long Island City, N. Y.. 7-30
8-14*Sewer, Louisville, Ky..... 7-30
8-20*Sewers, Forest City, Pa. 7-30
8-21*Sewer, Louisville, Ky..... 7-30
9- 1 Sewer, Jackson, Ohio 7-23
9- 7*Sewers, Vicksburg, Miss..... 7-30

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7-31*Roads, Newton, N. J..... 7-16
8- 1 Street impvt., Fond du Lac, Wis. 7-16
8- 1 Roads, Anderson, Ind..... 7-16
8- 1 Roads, Greencastle, Ind..... 7-16
8- 1*Macadam, Hillsdale, N. J..... 7- 9
8- 3 Grading, etc., Jacksonville, Fla. 7- 9
8- 3 Roads, Tipton, Ind..... 7-16
8- 3 Regulating, etc., Yonkers, N. Y.. 7-16
8- 3 Road, Greensburg, Ind..... 7-23
8- 3 Road, Columbus, Ind..... 7-23
8- 3 Street impvts., Lawrence, Kan.. 7-23
8- 3 Paving, Olympia, Wash..... 7-30
8- 4 Trap rock, etc., New York, N. Y. 7-30
8- 4 Street impvts., Ozark, Mo..... 7-30
8- 4 Road, Martinsville, Ind..... 7-23
8- 4 Road, Vincennes, Ind..... 7-16
8- 4*Grading, etc., Rome, Ga. 7- 9
8- 5 Roads, Bloomington, Ind. 7-16
8- 5 Roads, Muncie, Ind..... 7-16
8- 5 Roads, Frankfort, Ind..... 7-23
8- 5 Regulating, Brooklyn, N. Y..... 7-30
8- 6 Stone road, etc., Muncie, Ind... 7-23
8- 6 Roads, Brazil, Ind..... 7-23
8- 8 Road, Clinton, Tenn..... 7-30
8-10*Grading, Van Buren, Ark..... 7-23
8-10*Paving, Newburgh, N. Y. 7-30
8-10*Grading, etc., Verona, N. J..... 7-16
8-10*Pavement, Port Chester, N. Y.... 7-30
8-10 Asphalt, New York, N. Y..... 7-30
8-10 Paving, Spartanburg, S. C..... 7-30
8-11*Sidewalk, Saranac Lake, N. Y.... 7-30
8-11 Regulating, etc., Long Island City, N. Y. 7-30
8-12*Curb, etc., Eureka, Ill. 7-30
8-12 Grading, etc., Carrollton, Ohio.... 7-23
8-14*Roads, Phillipsburg, N. J..... 7-23
8-14 Grading, Memphis, Tenn..... 7-30
8-17 Road, Fowler, Ind..... 7-23
8-23 Road, Brookville, Ind 7-23

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7-30 Dredging, Cleveland, Ohio..... 7-30
7-31*Dredging, Boston, Mass..... 7-23
7-31 Steamer repair, New York 7-23
7-31 Engines, Prince Albert, Sask 7- 9
7-31*Wharf, Fort Mott, N. J. 7- 9
7-31*Dredging, Bangor, Me. 7- 2
7-31 Ry. grading, bridges, Canadian Pacific Ry..... 7-16
7-31 Incinerating plant, Scranton, Pa. (Garbage) 7-16
7-31 Dredging, Boston, Mass..... 7-30
7-31 Drain, New Orleans, La. 7-30
8- 1*Quay wall, Key West, Fla. 6-25
8- 1*Marine railway, Key West, Fla.. 7- 2
8- 1 Retaining wall, etc., Phila., Pa. 7- 9
8- 1 Coal-handling plant, N. Y. 7- 9
8- 1 Garbage crematory, Bellaire, O.. 7-23
8- 3 Ditch, St. Paul, Minn. 7-23
8- 3*Embankment, Greenville, Miss.... 7-23
8- 3 Garbage removal, Union, N J.... 7-30
8- 3 Drainage, Clarion, Iowa 7-30
8- 3 Embankment, Greenville, Miss.... 7-30
8- 3 Ditch, Sioux City, Iowa 7-30
8- 4 Drain, Estherville, Iowa 7-30
8- 4 Cleaning and painting steel, N. Y. 7-30
8- 5 Dredging, Brooklyn, N Y..... 7- 30
8- 5 Dredging, Pekin, Ill 7-30
8- 5 Ditch, Marshalltown, Iowa..... 7-16
8- 6*Breakwater, Ft. Morgan, Ala.... 7-16
8- 6*Pier, shed, San Francisco, Cal.... 7- 2
8- 7 Cableways, Panama 7-16
8-10 Pile dams, New Orleans, La..... 7-23
8-10*Abutment, Wheeling, W. Va..... 7-30
8-11*Cement, Columbus, Ohio 7-30
8-11 Barge canal, Albany, N. Y..... 7-23
8-11*Dredging, Trenton, N. J..... 7-16
8-12*Cement, Chicago, Ill 7-23
8-13*Wooden scow, New York, N. Y.. 7-23
8-14 Light-house, Alaska 5-21
8-18*Dredging, Trenton, N. J..... 7-30
8-18*Coal handling machinery, Philadelphia, Pa 7-30
8-20 Trans-Continental Ry, Ottawa, Ont. (Railways)..... 7-30
8-24*Cement, Detroit, Mich 7-30
8-24*Earth excavation, Detroit, Mich.. 7-30
8-25*Crematory, Fort Andrews, Mass.. 7-30
8-26*Metal work, Hawaii 7-30
8-26*Revetment, etc., Milwaukee, Wis. 7-30
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RAILWAYS.

(denotes that this work is advertised in Engineering News.)*

CHICAGO, OTTUMWA & WESTERN.—Preliminary survey has been started. This railway will be built from Ottumwa, Iowa, northwest via Hamilton to Des Moines, 85 miles. Capital, $3,000,000. J. T. Avery is Pres. and Secy., Hiteman; S. P. Pascoe, Vice-Pres.; A. A. McGarry, Treas., and John A. Nelson, Ch Engr., all of Hamilton. Noted on May 7, under Electric Railways.

CINCINNATI, DAYTON & FORT WAYNE.—This railway will be a standard-gage line, running from Cincinnati to Dayton and Fort Wayne, Ind., a distance of 194 miles. Capital stock, $3,000,000. Headquarters, 51 Davies Bldg., Dayton, Ohio. S. F. George, Dayton, is Pres. and Gen. Mgr.; Charles L. Hyde, Pierre, S. Dak., Second Vice-Pres.; Wm. D. Freeman, Dayton, Secy. and Treas.; B. B. George, Dayton, Purchasing Agent.

CINCINNATI, KENTUCKY & VIRGINIA.—It is officially announced that this company, which recently filed incorporation papers in Kentucky, will build a line from a point on the Ohio River near Cincinnati, Ohio, southeast to the Virginia State line, 160 miles. Surveys have been run for 40 miles. There will be a large number of tunnels and bridges. Harold R. Stone is Pres.; T. C. Bayland, Vice-Pres., 211 Railway Exchange Bldg., Chicago; W. D. Gerber is Ch. Engr., Yale, Ky. Noted on June 18.

COLORADO, TEXAS & MEXICO.—We are officially advised that track and bridge material for the first section 25 miles of the Colorado, Texas & Mexico R. R. from Mangum, Okla., to Olustee, Okla., is arriving at Mangum and Olustee. The COLORADO CONSTRUCTION CO., of Mangum, Okla., the general contractor, expects to complete this section and have trains in operation by Dec. 1, 1908. The company is in the market for rails and equipment. G. D. Locke is Vice-Pres., Mankum, Okla.

DELAWARE & HUDSON.—This company has filed a mortgage for $50,000,000 in favor of the Farmers' Loan & Trust Co., of New York. It is announced that extensive improvements and purchases are about to be made to modernize the system. The entire trackage and right-of-way, together with subsidiary and lease holdings, were mortgaged to raise money to pay off three mortgages by recalling the bonds and to gain security for issues of 4½ per cent. semi-annual bonds amounting to $43,500,000. The company operates railroad lines from Wilkes-Barre, Pa., via Albany, N. Y., to Rouse's Point, N. Y., with branches, 845 miles in all, as follows: Lines leased—Albany & Susquehanna, 142 miles; New York & Canada, 150 miles; Rensselaer & Saratoga, 192 miles; Chateaugay & Lake Placid R. R., 80 miles; Union R. R., 21 miles; Jefferson R. R. (trackage) 35 miles; other lines, 50 miles. Lines owned—Lackawanna & Susquehanna, 22 miles; Valley R. R. of Pennsylvania, 17 miles; Honesdale Branch, 28 miles; Schenectady & Mechanicville, 10 miles; Cherry Valley, Sharon & Albany, 21 miles; Schenectady & Duanesburg, 14 miles; Adirondack Ry., 57 miles; Cooperstown & Charlotte Valley, 24 miles; branches and spurs, two miles. James MacMartin is Ch. Engr., Albany.

GEORGIA.—We are officially advised by the Columbus (Ga.) Board of Trade that the matter of building a railroad from Columbus to Society Hill, Ala., is only under discussion. Committee will be appointed to investigate its feasibility. No company has been formed yet. A report states that the line would be 34 miles long, via Crawford, Ala. (14 miles), and Marvyn (18 miles). John S. Bleecker, Mgr., and C. M. Young, Gen. Supt. of the Columbus R. R. Co.; L. Lowenherz, Pres. of the Board of Trade of Columbus; W. F. Rutledge, of Crawford, Ala.; M. E. Edwards, of Seale, Ala.; J. W. Mayberry, of Marvyn, Ala., and Ward Johnson, of Girard, Ala., are among those interested.

GRAND RAPIDS & NORTH-WESTERN.—We are officially advised that this company will build a railroad from Ludington to Grand Rapids, Mich., 98 miles. Surveys are made and right-of-way secured. Company is not ready yet to announce details. Noted on June 4.

HUDSON BAY PACIFIC.—Contract for grading the first ten miles of this new transcontinental line to Fort Churchill, on Hudson Bay, has been let to JOHN HAGGARTY & CO., Victoria, B. C.

JOPLIN UNION DEPOT CO.— This company has been incorporated in Missouri to build the proposed union station in Joplin, but no definite plans have been made nor has the company organized. The Atchison, Topeka & Santa Fe Ry. Co. and the Missouri & North Arkansas R. R. Co. are equally interested. W. S. Dawley, Ch. Engr. of the Allegheny Improvement Co., which is building the Missouri & North Arkansas Railroad extension, is Ch. Engr. for the Joplin Depot Co., Security Bldg., St. Louis, Mo.

PITTSBURG, BINGHAMTON & EASTERN.—Contract has been awarded to W. J. OLIVER, of Knoxville, Tenn., for building this railroad. The line will extend from Clearfield, Pa., to Binghamton, N. Y., 225 miles, with 25-mile branch to Phillipsburg, forming a short low-grade line between the bituminous coal fields and New England and Canadian points. Organized September, 1906. The railroad is completed from Cedar Ledge to Powell, Pa., 21 miles. H. A. Schwanecke is Ch. Engr., Canton, Pa. Noted on Jan. 23 and Feb. 27, 1908.

QUINCY & EASTERN.—The Board of Supervisors of Plumas County, Quincy, Cal., has granted a franchise to A. W. Rutledge, of Oakland, for the Quincy & Eastern R. R. The line, as projected, will be built through American Valley from Quincy to the Western Pacific Railroad, and is to be completed on or before Jan. 1, 1909. It is to be a standard-gage road, with either steam or electricity as the motive power. Residents of Quincy a year ago subscribed some $15,000 for this purpose.

TERRE HAUTE, HOBINSON, OLNEY & SOUTHWESTERN.—We are officially advised that surveys are partly made for this railway, which will run from Terre Haute, Ind., southwest via Robinson, Ill., and Olney to Mount Vernon, Ill., 125 miles, where connection is to be made with the Wabash, Chester & Western, running to the Mississippi River. Company may ultimately build an extension on the Missouri side of the Mississippi River, southwest about 60 miles. Right-of-way is partly secured. Company is not yet prepared to announce date for letting contracts. Horace C. Pugh, Terre Haute, is Pres., Baxter L. Brown is Ch. Engr., Lucede Bldg., St. Louis, Mo. Previously noted.

TEXAS & NEW ORLEANS.—Contract will be let soon for building the proposed line from Gallatin to Rusk, Tex., 17 miles. W. G. Van Vleck is Vice-Pres. and Mgr., Houston, Tex.

THESSALON & NORTHERN.—The Dominion Government has granted a subsidy to this company for a line northerly from Thessalon, Ont., for a distance not to exceed four miles.

TRANS-CONTINENTAL RY.—Bids are asked by the Trans-Continental Railway Commissioners, Ottawa, Ont., until noon, Aug. 20, for the work required for the construction, in accordance with the plans, profiles and specifications of the commissioners, of the following sections of the Trans-Continental Railway:

(1) District "C"—From a point near Weymontachene, Que., 196.38 miles west of the north abutment of the Quebec bridge (such point being on the boundary between districts "C" and "D") westerly for a distance of about 107 miles. Dec. 31, 1910.

(2) District "C"—From a point about 107 miles west of Weymontachene, westerly to the end of the Grand Trunk & Pacific Ry. Co.'s contract, a distance of about 114.97 miles. Date of completion, Dec. 31, 1910.

(3) Districts "D" and "E"—From a point being at the western end of Fauquier Bros.' Abitibi contract, in the province of Ontario, in a westerly direction for a distance of about 104.24 miles. Date of completion, Dec. 31, 1910.

(4) District "E"—From a point about 60 miles west of the easterly boundary of district "E," in the province of Ontario, easterly to the end of Fauquier Bros.' contract, north of Lake Nepigon, a distance of 100 miles. Date of completion, Dec. 31, 1910.

(5) Districts "E" and "F"—From a point

at the western end of Fauquier Bros.' contract north of Lake Nepigon, Ontario, westerly to a point at or near Dog Lake, a distance of about 126 miles. Date of completion, Sept. 1, 1910.

(6) District "F"—From a point near Dog Lake, Ontario, to a point at or about mile 2.6 west of what is known as Peninsula Crossing, by alternative routes as shown on the plans, a distance of about 23.76 miles by the northerly route and 24.13 miles by the southerly route, the selection of the route to be at the option of the commissioners. Date of completion, Sept. 1, 1909. H. D. Lumsden, Ch. Engr., Ottawa.

VICTOR & EASTERN.—Incorporated in California with $150,000 capital, to build from Victorville to the Black Mountains, eleven miles, thence east to a point not yet determined. F. H. Merrell, H. Albright, A. A. Baird and A. Moore, of Los Angeles; J. J. Meachan, of Racine, Wis.; C. H. Hamilton, of Pasadena, and F. Banks, of South Pasadena, are interested.

WATAUGA R. R.—This company has been chartered and organized in North Carolina. The towns of Blowing Rock and Boone, in Watauga County, as well as Watauga County, are interested in plant to build this line from Blowing Rock or Boone to connect at Edgemont with the Caldwell & Northern R. R. Preliminary surveys have been made through Cooke Gap and Kelsey Gap, on the Blue Ridge, to Yadkin and Wilson valleys, on the east of the Blue Ridge. L. T. Nichols is Gen. Mgr. of the Caldwell & Northern R. R. Co., at Lenoir, N. C.

ELECTRIC RAILWAYS.

EAST AURORA, N. Y.—Henry C. Jewett is organizing company to construct electric railroad from East Aurora to Jewettville via resort hotel to be erected by himself three miles from East Aurora and 2½ miles from connection with Buffalo, Rochester & Pittsburg, R. R., at Jewett..

LIMA, N. Y.—We are officially advised that the Lima-Honeoye Elec. Light & R. R. Co. expects to let contracts this year for its extension north to Rochester and south to Atlanta, N. Y., 69 miles. Company now operates five miles of line. Right-of-way is partly secured. Survey has been made. E. D. Watkins Mgr.; C. A. Watkins is Ch. Engr.

NEW YORK, N. Y.—Following the failure of the New York & Port Chester R. R. Co. to comply with the order of the Public Service Commission to furnish information showing how far the road had gone in the work of construction in accordance with the terms of the franchise granted the company by the Board of Aldermen on May 31, 1906, Commission John G. Eustis has started an investigation into the affairs of the company, according to the New York "Tribune." The franchise was granted only after a long fight with the New York, Westchester & Boston Railway Co. for the sole privilege of building an electric railroad in the Bronx to connect the subway with Westchester County. Under the terms of the franchise the Port Chester Company was required to expend at least $800,000 upon construction work within two years from the date of the franchise, but since that time both companies have passed under the control of the New York, New Haven & Hartford interests. On May 5 last the Board of Aldermen asked the Public Service Commission to ascertain from the Port Chester Company what it had done to fulfil the conditions of the franchise. F. M. Blanchard is Secy., 37 Wall St.

WAYNESBURG, PA.—W. J. Sheldon, Pres. of the South Brownsville, Carmichaels & Waynesburg Ry. Co., McKeesport, Pa., informs us that T. H. Shannon, Atty.' Sayres Bldg., Waynesburg, will apply for a charter for this company on August 19. Company will be organized with $120,000 capital, which is all arranged for. T. M. Latimer, Smith Block, Pittsburg, is fiscal agent for this company. Construction contracts will be let the latter part of August. Preliminary survey has been made and franchises obtained. The line will connect South Brownsville, Waynesburg, Carmichaels, Rices Landing, Zollarsville and Millsboro, and will be about 20 miles long. See also Brownsville (Pa.) item in issue of June 18.

LANCASTER, PA.—The Lancaster & York Furnace St. Ry. Co. plans to build a 5-mile extension to its line. J. R. Kreider is Gen. Mgr., Millersville, Pa.

ROCHESTER, PA.—Governor Stuart has approved the merger of eight trolley lines in western Pennsylvania under the name of the Suburban Railway Co., with a capital of $150,000. Headquarters are at Rochester. The companies consolidated are the original Suburban Electric Ry., Freedom & Baden, Sewickley & Leetsdale, Beaver & Bridgewater, the Beaver Falls, the Rochester, Beaver and Vanport, New Brighton, Beaver Falls & Marado, and the Economy & Harmony Electric St. Ry. companies. The new officers are: W. A. Park, Rochester, Pres.; Samuel Morgan, Freedom, J. H. Park, P. A. Smith and Charles Connel, of New Brighton.

WASHINGTON, D. C.—The Washington, Arlington & Falls Church Railroad Co. has passed from a receivership into the control of a syndicate represented by R. A. Chester, formerly Vice-Pres. of the Commercial National Bank. Mr. Chester has been elected President, and J. W. Rich, Secy. and Treas. The new owners are said to be closely allied with the Washington, Alexandria & Mt. Vernon Railway, and contemplate many improvements, including an immediate expenditure of $100,000 for this purpose.

WHEELING, W. VA.—Regarding the report that the Wheeling Traction Co. may extend its line to Moundsville this summer, we are officially advised that no extension is to be made this year. H. O. Nagle is Supt.

SPARTANBURG, S. C.—The Spartanburg Ry., Gas & Elec. Co. will build about ten miles additional track. B. Buckheister is Supt.

NASHVILLE, TENN.—The Gallatin Pike Ry. Co. has been incorporated for the purpose of building and operating either a steam or an electric railway along the line of the Gallatin Pike from the present extension of the Nashville Railway & Light Company's line to a point on said pike where it is intersected by Maplewood Lane, a distance of about two miles. Capital stock, $25,000. Incorporators: E. B. Rucker, C. H. Gillock, M. H. Sharpe, P. A. Shelton and J. H. Zarecor, of Nashville.

SALEM, OHIO.—Peter McCave, of Gettysburg, Ohio, is promoting an electric railway to be built from Salem to Gettysburg, Greenford, Calla, Canfield and Youngstown. Right-of-way is being secured. Survey has been made.

SPRINGFIELD, OHIO.—We are officially advised that the Springfield & Washington Ry. Co., incorporated recently to build a line connecting Springfield, Washington Court-House and Chillicothe, will build 24 miles of new line between South Charleston and Washington Court-House. Geo. W. Balsr. Springfield, is Pres. Surveys have been run but right-of-way has not yet been secured. Capital stock, $1,000,000. The property of the Washington Traction Co., which is in operation between Springfield and South Charleston, 14 miles, has been purchased by the S. & W. Co., which has been organized to complete the line in accordance with the original plans, as noted on June 18.

STEUBENVILLE, OHIO.—Construction will be started soon by the Steubenville & Canton Elec. Ry. Co. Right-of-way is being secured. Surveys have been made. The line will be 62 miles long and will pass through Wintersville, Richmond, East Springfield, Wolf Run, Carrollton, Hibbets, Malvern, Waynesburg, Marks and Waco. Estimated cost, $2,750,000. The officers of the company are: Pres., E. E. Francy, Vice-Pres. of the People's National Bank, Steubenville; Vice-Pres., J. C. Bigger, Steubenville; Secy. and Treas., H. H. Smith, Steubenville; Gen. Mgr. and Ch. Engr., T. H. Loomis, Steubenville; Attorney, Wm. B. Quinn, Steubenville.

ELWOOD, IND.—The Elwood & Swayzee Traction Co. has been incorporated in Indiana to construct and operate an electric railway between Elwood and Swayzee, a distance of twelve miles. Capital stock, $10,000. Office, Elwood. Directors: E. C. Gwinn, A. H. Curtis, N. A. Coleman, C. C. Hill and John Hume.

FRANKFORT, IND.—The Commissioners of Clinton County have ordered special elections to be held in Ross and Center Townships on Aug. 11 to vote on the proposition of a subsidy tax of $15,000 and $50,000, respectively, in aid of the construction of the Frankfort & Delphi Elec. Ry.

MONROE, MICH.—The Toledo, Ottawa Beach & Northern Ry. Co. has been granted a franchise to build an electric railway in Monroe. This company operates 15 miles of line in and about Toledo.

CHANUTE, KAN.—The Chanute Elec. Ry. Co. will start construction work on a 10-mile standard-gage street railway system in Chanute within 30 days. The overhead trolley system will be used. The power station will be located at Chanute. An amusement park will be run by the company two miles west of the city. The company also proposes to sell current for lighting. William Gray, Pres.; S. W. Brewster, Secy.; D. M. Kennedy, Treas., all of Chanute. Noted on July 16.

AVA, MO.—The Kansas City, Ozarks & Southern Elec. Ry. Co. has been incorporated in Missouri to build and operate a standard-gage electric railway between Mansfield, Wright County, and Ava, Douglas County, a distance of 15 miles. Capital stock, $300,000. Incorporators: J. H. Murray, H. E. Bush, J. M. Adams, A. P. Miller and J. S. Clark, all of Ava. The following officers have been elected Pres., Albert Parker; Vice-Pres., J. S. McIntosh; Secy., George W. Wilhelm, all of Kansas City, Mo.; J. B. Quigley, of Sedalia, Mo., is Ch. Engr. and Gen. Mgr., and C. H. O'Neill, of Topeka, Kan., Purchasing Agent. The surveys of the line between Ava and Mansfield have been completed. Noted on April 9.

CANON CITY, COLO.—S. H. Atwater, Pres. of the Kansas-Colorado R. R. Co., Canon City, informs us that surveys are partly made for the projected railroad from Canon City to Garden City. Contract has been let to A. B. HULIT, Central Block, Pueblo, Colo., for construction of the western division. The total length will be about 350 miles. W. C. Davis of the General Electric Co., is Ch. Engr., Schenectady, N. Y. Noted on June 25.

TEMPLE, TEX.—The Temple & Marlin Elec. Ry. Co. is being organized to construct an electric railway from Temple to Owensville, Belfalls, Salada and Marlin, 50 miles, to be operated by electricity. Construction work probably will be started soon. Capital stock will be $30,000. The promoters also contemplate operating a number of amusement parks along the route. Noted on July 16.

TACOMA, WASH.—The Narrows Terminal Belt Line Ry. Co. has been incorporated to construct an electric railway from the end of Center St. to Belmarlow Beach. The company also intends the construction of a power plant near American Lake. A water right allowing it to take 2,000 ft. of water per second from the lake has been filed. Capital stock, $250,000. Incorporators: Lucian F. Cook, Henry L. Gray, Charles E. Cutter, C. A. Tonneson and Fred S. Cook, Tacoma.

CLATSKANIE, ORE.—The Clatskanie & Nehalem Valley Electric Ry. Co. will be organized to promote the building of an electric railway from Clatskanie to Jewell, a distance of about 33 miles. Preliminary surveys will be made immediately. D. R. Nelson, Portland, Ore., is named as promoter.

PENDLETON, ORE.—James H. Gwinn has applied for a franchise to build a street railway on certain streets of Pendleton.

ST. CATHARINES, ONT.—Final survey has been completed by the Niagara, St. Catharines & Toronto Ry. Co. for its proposed extension to Welland. Contracts will be let soon. S. Gagnier is Engr.; E. F. Seixas is Gen. Mgr., St. Catharines.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

BELLOWS FALLS, VT.—We are officially informed that the contract has been let to the ABERTHAW CONSTRUCTION CO., 8 Beacon St., Boston, for the new dam to be built for Bellows Falls Canal Co., Bellows Falls, in accordance with the plans of Chas. T. Main, Engr., 45 Milk St., Boston. It will be erected directly in front of and bordering the front of the existing crib dam, and will be about 600 ft. long, varying in height from 30 to 2 ft. It will be built of solid concrete throughout. A part of the old dam which this is to replace is over 100 years old. The present trouble and leakage which the new dam is designed to obviate comes largely from this old construction. Work is to be started at once and pushed rapidly.

LAWRENCE, MASS.—Bids are asked by the County Commissioners, Salem, Mass., until 9.30 a. m., Aug. 3, for furnishing material and constructing a central heating and electric lighting plant for the Essex County Training School at Lawrence, Mass. Plans and specifications are on file and may be consulted at the office of the County Commissioners at Salem, at the Essex County Training School at Lawrence, and at the office of George Huey, Consult Engr., 7 Water St., Boston.

SHREWSBURY, MASS.—The Board of Selectmen has voted to borrow $16,000 to install an electric light plant to furnish electricity for street lighting and for domestic and commercial purposes. The town voted last May to establish a municipal plant.

HARTFORD, CONN.—Bids will be received by the Board of Contract and Supply until Sept. 14 for lighting the streets of the city with electricity for terms of one and five years.

SYRACUSE, N. Y.—We are officially advised that the CONSOLIDATED ENGINEERING & CONSTRUCTION CO., 1 Madison Ave., New York, has been awarded contract for extension to the power house at Syracuse University. Estimated cost, $50,000.

CANTON, N. Y.—The Canton Electric Light & Power Co. has been granted authority by the Public Service Commission to issue $16,000 of bonds, the proceeds to be used to increase and improve its service. The company has entered into a contract with the Northern Power Co., of Hannawah Falls, N. Y., for electrical energy for a term of 20 years, and proposes to equip a substation, substitute new and improved meters and transformers for the ones now in use and to build additional transmission lines. Jas. E. Johnson, Canton, is Mgr.

LATROBE, PA.—The WEST PENN ELECTRIC CO., of Connellsville, Pa., has been awarded the contract for furnishing electric light for the city for a period of one year.

WASHINGTON, D. C.—Bids are asked by Col. Wm. S. Patten, Depot Q. M., 39 Whitehall St., New York, until 2 p. m., Aug. 4, for furnishing 111,000 incandescent electric lamps for the Quartermaster's Department; also alternate proposals, in quintuplicate, for furnishing 272,500 of these lamps to be delivered to the Treasury and Quartermaster's Departments, Library of Congress, and the State, War and Navy Buildings.

NEW YORK, N. Y.—See Washington, D. C.

*WHEELING, W. VA.—Bids are asked by Capt. F. W. Altstaetter, Corps Engrs., U. S. A., until 11 a. m., Aug. 26, for building a power-house at each of Dams Nos. 18, 19 and 26, Ohio River.

RALEIGH, N. C.—The Central Carolina Power Co. has formally changed its name to the Carolina Light & Power Co., increased capital stock from $1,000,000 to $3,750,000 and removed office from Fayetteville, N. C., to Raleigh, according to the "Manufacturers' Record." Company's water-power electrical development is at Buckhorn Falls, on Cape Fear River. James D. Mortimer, of New York, is Pres.; Egbert Douglas is the representative at Raleigh.

ASHEVILLE, N. C.—The Weaverville Electric Co. has been incorporated with $100,000 capital stock by R. S. Howland, J. H. Carter, G. W. Eppes, and others, to generate electricity for power, lighting, etc. The company, it is said, is to succeed the North Carolina Electric Power Co., reported as having been purchased by W. T. Weaver and associates. Chas. E. Waddell, of Asheville, N. C., is reported to be preparing plans.

TROY, N. C.—S. J. Smitherman and J. C. Hurley will build a dam to develop from 1,000 to 2,000 HP. for operating cotton mills here. They will first furnish power to the Smitherman Cotton Mills, of which Mr. Smitherman is Pres., and next year build another mill. Construction of the dam has begun. It will be 22 feet high, giving a 40-ft. head. It is located on Little River, five miles from Troy. The Smitherman Cotton mills have 5,000 spindles and 216 looms, producing ginghams, domets, etc.

SENECA, S. C.—City will establish a municipal electric light plant. It has been voted to issue $18,000 of bonds, the proceeds to be used for the construction of the plant. Bids will be received for the bonds until Aug. 1. G. W. Grant is Clerk.

ATHENS, GA.—The University of Georgia has secured a $15,000 appropriation for heating and lighting school; David C. Barrow is Chancellor.

LAKELAND, FLA.—The City Council has called an election, to be held on Aug. 17, to vote on the proposition to issue $40,000 of bonds for public improvements, of which $5,000 will be used for additions and extensions to the municipal electric light plant and $15,000 for the water-works system. R. R. Daniels is Supt.

STARKE, FLA.—City has voted $12,000 of bonds to extend and improve electric-light plant and water-works. W. L. Wall is Supt.

GADSDEN, ALA.—R. H. Cobb, of Anniston, Ala., is reported to be preparing plans for permanent organization of the Coosa River Power Co., which contemplates the construction of a dam at Lock [illegible], to develop from 25,000 to 30,000 H. P. The War Department is now making surveys of the Coosa River. Congress will be asked to grant certain privileges and make appropriations to provide for the construction of the dam.

MANSFIELD, LA.—Plans are being considered for extensive improvements to the municipal electric light plant. F. [illegible] Lawrence is Mgr.

LOGANSPORT, IND.—The Board of Public Works and the City Council has acted upon the plan of re-equipping the municipal electric light plant and has contracted with Prof. Esterline, of Purdue University, to prepare the specifications. As soon as the specifications are completed the Board of Public Works will purchase the necessary machinery and equipment. J. Loftus is Supt.

WASHINGTON, IND.—The Washington Water, Light & Power Co. has been incorporated to improve and rebuild the plant recently acquired at receivers' sale. Jas. P. Goodrich, E. H. Gates and J. [illegible] Boorman are the Directors.

MENOMINEE, MICH.—Jacobson De Guere, Archs. and Engrs., Grand Rapids, Mich., will prepare plans and specifications for a 7,000-HP. hydro-electric power plant to include a concrete dam about 500 ft. long, a dyke 1,000 ft. long, a canal on the opposite side of the river, leading to the power house, 4,000 ft. long, a reinforced concrete power-house and flume, for the Menominee & Marinette Light & Traction Co., Menominee, Mich., to be constructed at Grand Rapids, on the Menominee River, about 18 miles north of Menominee.

*STURGEON BAY, WIS.—Bids will be received on July 7 by H. C. Leonhardt, City Clerk, for constructing an electric light plant and water-works system. Contracts were awarded as follows: ERIE CITY IRON WORKS, Erie, Pa., boilers, $4,487; ERIE CITY IRON WORKS, engines, $3,490; PLATT IRON WORKS, Dayton, Ohio, pump, $2,251; M. V. COCHEMS, Sturgeon Bay, Wis., building power-house, $2,390; WESTERN ELECTRIC CO., Chicago, generators, etc., $6,023. Total cost, $22,328.

*PORT WASHINGTON, WIS.—Bids are asked by W. B. Krause, City Clerk, Port Washington, until 7.30 p. m., Aug. 25, for three 100-HP. water-tube boilers; one 100-HP. and one 200-HP. tandem, compound condensing Corliss engines; one 75-KW. and one 150-KW., 3-phase, 60-cycle, 2,300-volt generators; one three-panel switchboard, one 75-lt. arc transformer and regulator, one 60-HP. induction motor, together with accessories, such as exciters, feed pumps, heaters, condenser, piping, belting, boiler settings, etc. Also one brick addition to power-house and one stack. Bids will be received on the whole or any part of the plans. Plans and specifications will be on file at City Clerk's office, Port Washington; at 31 Vroman Bldg., Madison, Wis.; at Builders' & Traders' Exchange, Milwaukee, and at the office of F. W. Dodge Co., Monadnock Block, Chicago, Ill., on and after Aug. 11. W. G. Kirchoffer, Engr.

HARTFORD, WIS.—Bids are asked by A. J. Hemmy, City Clk., until 7.30 p. m., Aug. 7, for constructing power-plant for the municipal electric light plant. The work will consist of a brick power house, brick chimney, two steam engines and two steam boilers; or in lieu of these, a gas producer plant, two electric generators, alternating type, with switchboards, street lamps, transformers, regulators, etc., for a complete power-house installation. Plans and specifications can be seen at the office of the City Clerk, Hartford, or at the office of A. T. Maltby, Consult. Engr., 803 Great Northern Bldg., Chicago, Ill.

SIDNEY, IOWA.—City has voted in favor of establishing a municipal electric-light plant.

MELROSE, MINN.—Plans are being considered for increasing the equipment of the municipal electric-light plant, including the installation of an additional boiler.

ATKINS, ARK.—W. F. Turner, of Atkins, has been granted a franchise by the City Council to construct and operate an electric light system in this city. Mr. Turner will organize a company to build a plant to cost $5,000.

HOUSTON, TEX.—The Texas Power Co., Ltd., 300 Stewart Bldg., recently incorporated to manufacture and supply gas, light, heat and electric power, will erect reinforced concrete buildings to cost $30,000. The cost of machinery, including gas producers, gas engines and direct-connected generators will be about $1,000,000. Capacity of plant, 10,000 HP. C. A. Cleaver is Pres.

CUREO, TEX.—W. M. Ratcliffe, Brownsville, Tex., has purchased dam across Guadalupe River and will rebuild burned electric power-house and install temporory machinery until permanent betterments can be provided. Company will furnish city with electric lighting and power.

BLISS, OKLA.—W. W. Lockwood, Winfield, Kan., will erect electric-power house to furnish power for lighting ranch.

FAIRVIEW, OKLA.—Bids will be received by C. E. Dunnell, Town Clerk, for furnishing equipment and machinery for the municipal electric power plant, to be delivered f. o. b. at Rusk, as follows: One 75-KW. alternating-current generator and exciter; one 60-KW. alternating-current generator and exciter; one 400-gal. per min., single-acting triplex power pump; one 300-gal. per min. double-acting, triplex power pump, and for furnishing and erecting on foundations furnished by the town two 100-HP. gas producer units. Plans and specifications may be obtained from Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., the Engrs. D. R. Thomas is Pres. of Council.

PORTLAND, ORE.—The Portland Railway, Light & Power Co. has awarded contracts for the construction of an underground system of conduits and cables in the business

district of Portland to WILLIAM S. BARSTOW & CO., 50 Pine St., New York. The contracts amount to more than $1,000,000.

REDDING, CAL.—Notice of appropriation of 5,000 inches of the water of Bear Creek in Shasta County has been filed by H. Shannon. The water is to be used for irrigation, domestic purposes and for the generation of electricity.

WINNIPEG, MAN.—Bids will be received until Sept. 15, for electric lighting plant and carbons. For fuller information apply F. A. Cambridge, City Electrician, or M. Peterson, Secretary Board of Control, Winnipeg.

REGINA, SASK.—Bids will be received by S. P. Mayer, Deputy Minister of Railway and Telegraphs, until July 30 for the supply of insulators, top pieces, crossarms, guy wire and pole line hardware necessary for the construction of the government telephone system.

VICTORIA, B. C.—Bids are asked by W. Northcott, City Purchasing Agent, until Aug. 3 for 40,000 7/16 in. × 12-in. copper-coated carbons and 10,000 7/16-in. × 8-in. copper-coated carbons.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

SOMERVILLE, MASS.—We are officially advised that the contract for constructing a reinforced concrete bridge at Alewife Brook, Mystic Valley Parkway, Somerville, has been awarded by the Metropolitan Park Commission to JAMES H. FANNON, Somerville, at $10,212. Other bidders were: Falvey & Kelley, Dorchester, Mass., $17,900; Fred T. Ley & Co., Inc., Springfield, Mass., $17,776; W. A. Murkfeldt Co., Boston, Mass., $15,514; McHae & Perkins, Boston, $13,332; T. Stuart Son Co., Newton, Mass., $11,880; Coleman Bros., Boston, $11,670. John R. Roblin is Engr.

ITHACA, N. Y.—The Lehigh Valley R. R. Co. has awarded the contract to the PENNSYLVANIA STEEL BRIDGE CO. for erecting a steel bridge over Fall Creek, Ithaca.

ROCHESTER, N. Y.—Frederick K. Skene, State Engr., Albany, is preparing plans for bridges over the Erie Canal, at Lyell Ave. and at Allen St., Rochester. Both bridges are to be of the bascule type, operated by electricity. Estimated cost, $50,000 and $55,000, respectively. Bids will be asked this fall by F. C. Stevens, State Supt. of Pub. Wks., Albany.

BUFFALO, N. Y.—The Grade Crossing Commissioners, 436 Ellicott Square Bldg., have received bids for two groups of grade crossing improvements, Group No. 1, Elk St. improvement and group No. 2, Belt line improvement. The Eastern Concrete Steel Co., Morgan Bldg., was the lowest bidder, at $58,423, and $141,195, respectively. Edward B. Guthrie is Ch. Engr.

*RYE, N. Y.—Bids are asked until 8 p. m., Aug. 12, by the Village Clerk, for furnishing all labor in Bradford Ave. The work will be divided and separate bids received as follows: Foundations, including piles, concrete and rubble masonry; steel superstructure, erected complete with concrete floor. Span of bridge, 21 ft., width, 25 ft. Craig E. Nightingale is Village Engr.

*PHILADELPHIA, PA.—Bids were opened on July 24 by George R. Stearns, Dir. Pub. Wks., for the construction of a bridge to carry the tracks of the Tabor branch of the Reading Railway over Belfield Ave., 42d Ward, and for five concrete land piers for the Passyunk Ave. bridge over the Schuylkill River as follows: For the construction of the five concrete land piers on pile foundations for the Passyunk Ave. bridge, David Peoples, Betz Bldg., $46,900, six months; McGaw & Gray, Pennsylvania Bldg., $48,000, six months; American Paving & Construction Co., 211 South Ninth St., $48,385, six months; Filbert Paving Co., Pennsylvania Bldg., $51,300, four months; Sparks & Evans, 14 South Broad St., $65,500, eleven months; for the construction of the Belfield Ave. bridge, to be of solid concrete construction, American Paving & Construction Co., $47,390, five months; Cramp & Co., Commonwealth Block, $52,000, eight months; McNichol Paving Co., $53,770, 12 months; McGaw & Gray, $58,000, seven months; David Peoples, $59,500, six months; R. P. Bennis, 24th St. and Westmoreland Ave., $59,700, six months; Richard Walsh, 25th and Sedgley Sts., $62,325, nine months; Thomas F. Riley, Philadelphia, $67,627, eight months.

PHILIPSBURG, PA.—Bids were opened on July 6 by the Commissioners of Clearfield and Center Counties at the Passmore House, Philipsburg, for constructing a joint bridge between the Borough of Philipsburg and Chester Hill. The contract was awarded to R. A. SCOTT, of Barnesboro, Pa., at $3,498. J. H. Wetzel is Engr., Bellefonte, Pa.

BETHLEHEM, PA.—Bids are asked until Aug. 6 by the Board of County Commissioners of Northampton and Lehigh Counties at Easton, Northampton County, for constructing a reinforced concrete arch bridge over the Monocacy Creek at Broad St., Bethlehem, to be 450 ft. long, with two cement sidewalks, each 8 ft. wide, roadway of brick, 41 ft. wide and two trolley tracks. L. Francisco is Engr., Easton, Pa., Robt. S. Rathbun is Engr., Allentown, Pa.

LANCASTER, PA.—Bids are asked by the Street Committee at the office of J. H. Rathfon, City Controller, until Aug. 4 for the construction of a steel plate girder bridge on West James St., across the Pennsylvania R. R. tracks. J. S. Carpenter is City Engr.

SALISBURY, MD.—Bids are asked by the County Commissioners of Wicomico County, until noon, Aug. 18, for the construction of a steel plate girder draw-bridge over the Wicomico River at the crossing of Main St. H. M. Clark is Roads Engr.

CUMBERLAND, MD.—The Allegheny County Road Directors have awarded contracts for the construction of three bridges, as follows: Bridge over Potomac River at McCoole to the RIVERSIDE BRIDGE CO., Wheeling, W. Va., three spans, $4,117; concrete, $6.52 per yd.; dry excavation, $1.50; wet excavation, 75 cts.; Wiley's Ford bridge, over Potomac River, to WILLIAM FARRUS & BRO., Pittsburg, Pa., three spans, $4,000 complete; Evits creek bridge at Williams road, one span, to NELSON MEREDITH CO., Chambersburg, Pa., $1,540. George D. Townsend is Rd. Engr., Frostburg, Md.

HIGH POINT, N. C.—Davidson County will have an iron bridge constructed over Abbott's Creek, near here.

TAMPA, FLA.—Bids are asked by the Board of Commissioners of Hillsboro, County until Aug. 4 for constructing several bridges.

MIDDLETOWN, OHIO.—The County commissioners on July 14 opened bids for the bridge across the canal at Tytus Ave., as follows: The CAPITAL CONSTRUCTION CO., of Columbus, Ohio, $12,500 (awarded contract); Wyrckoop, McGomley Co., of Cleveland, Ohio, $14,000. J. E. Brate is County Audr.

MEDINA, OHIO.—Bids are asked by the Board of Commissioners of Medina County until 11 a. m., Aug. 1, for constructing the sub and superstructure of a bridge.

CLEVELAND, OHIO.—Bids are asked until 11 a. m., Aug. 19, by the Commissioners of Cuyahoga County for bridge work in Euclid Township and for constructing concrete arches in Mayfield Township. A. B. Lea is County Engr.

SOUTH BEND, IND.—The ELKHART BRIDGE & IRON CO., Elkhart, Ind., has been awarded the contract by the County Commissioners for the construction of two steel I-beam bridges and one steel pony truss bridge. John W. Harbou is County Audr.

LEBANON, IND.—Bids are asked by the Commissioners of Boone County, at the office of B. F. Hedrich, County Audr., until 1 p. m., Aug. 3, for the construction and repair of certain bridges.

ROCHESTER, IND.—Bids are asked by the Commissioners of Fulton County until 2 p. m., Aug. 3, for the construction of six steel and wrought-iron bridges in Liberty Township. George W. DuBois is County Audr.

NEWPORT, IND.—Bids are asked by H. T. Payne, County Audr., until 10 a. m., Aug. 10, for constructing three small bridges in Clinton Township. Carl H. Conley is Engr.

TERRE HAUTE, IND.—Bids are asked until Aug. 1 by the Board of County Commissioners for constructing a concrete circular arch bridge over the branch of Little Honey Creek on Hulman St. road. Nathan G. Wallace is County Audr.

MUNCIE, IND.—The INDIANA BRIDGE CO. has been awarded the contract for constructing four bridges for the county.

*AURORA, ILL.—Bids are asked until 2 p. m., Aug. 8, by the city for constructing two reinforced concrete arch bridges across Fox River on Fox St. E. J. Raymond is City Clk.

*CHICAGO, ILL.—Bids are asked by the Sanitary District of Chicago until noon, Sept. 2, for the equipment of the 8-track bridge at Campbell Ave. Details given in two advertisements in this issue.

MENASHA, WIS.—Bids are asked until Aug. 1 by Ruben Thompson, Town Clk., for constructing a stone arch bridge.

UNIONTOWN, KAN.—Bids are asked by the Commissioners of Bourbon County, Court House, Ft. Scott, until noon, Aug. 5, for constructing the substructure, consisting of stone abutments, wings, riprap fill and excavation of one iron bridge across the Marmaton River, about two miles southeast of here. C. E. Holstein is County Clk.

KANSAS CITY, MO.—J. L. Darnell, Engr., City Hall, is preparing plans for a steel or reinforced concrete bridge, over Blue River, for this city. Estimated cost, $24,000.

SAN ANTONIO, TEX.—Bids are asked until Aug. 12 by the Commissioners' Court for constructing a steel bridge across the San Miguel River, near the Tilden and San Antonio crossing on said river. W. C. Wheeler is County Judge.

HOBART, OKLA.—Bids are asked by the Boards of Commissioners of Kiowa and Greer Counties, at the office of C. H. Fawks, County Clk., Kiowa County, until 10 a. m., Aug. 13, for building an extension to the wagon bridge across the north fork of the Red River, on the public road between Granite and Lone Wolf, in Greer and Kiowa Counties.

CHICKASHA, OKLA.—The Grady County Commissioners will expend about $20,000 for the construction of several bridges. Edward F. Johns is Comr.

MUSKOGEE, OKLA.—A bridge to cost $50,000 will be constructed across the Canadian River, near Briartown, about two and one-half miles north of the old McMurray Station.

BEVERLY, WASH.—The GATES & RIGERS CO. has been awarded the contract for putting in the falsework for the steel bridge to be constructed across the Columbia River. The company has completed the 16 large concrete piers, and will soon have the bridge ready for the steel.

NORTH VANCOUVER, B. C.—Bids are asked until Aug. 7 by the District Council for constructing a 140-ft. span steel truss bridge. Donald Cameron is Dist. Engr.

LUMSDEN, SASK.—The contract for the abutments for the steel bridge across the Qu-Appelle River here has been awarded to SYDNEY BROS., of Regina, Sask.

*HAVANA, CUBA.—See under U. S. Possessions and Cuba.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

CAPE COTTAGE, ME.—Bids are asked until Aug. 1 by the Quartermaster, Fort Williams, Me., for repairs and alterations to the post hospital.

HAVERHILL, MASS.—Contract has been awarded by the High School Building Commission to JOHN M. ROCHE, Haverhill, for the erection of a high school building to be erected at Main and Summer Sts. Kilham & Hopkins, 9 Park St., Boston, Mass., are Archs.; W. W. Roberts is Clerk of the Comn.

CENTRAL FALLS, R. I.—Fontaine & Kinnicutt, Archs., Commercial Bldg., Woonsocket, R. I., have prepared plans for a parochial schoolhouse at Central Falls. Estimated cost, $75,000.

PROVIDENCE, R. I.—Contracts will be let in September by the Joint Standing Committee on City Property for a 12-room school building. Chas. R. Makepeace is Chn.; D. F. Hayden is Clk. Noted on July 2.

NEW BRITAIN, CONN.—Max Unkleback, Arch., New Britain, has prepared plans for a new 2-story administration building at the town farm. This building will be 36 × 60 ft., constructed of brick. Plans and specifications may be had from the architect.

The B. H. HIBBARD CO., the general contractor for remodelling City Hall, has let the following sub-contracts: Steel, the AMERICAN BRIDGE CO., Berlin, Conn.; castiron, the VANDERMAN MFG. CO., Willimantic, Conn.; vault doors, the MOSLER SAFE CO., Boston, Mass.; electric work, NEW ENGINEERING CO., New Britain; plumbing, GEORGE RAPELYE, New Britain; heating, PARKER & O'CONNOR, New Britain; marble work, VERMONT MARBLE CO., Boston; painting, JOHN BOYLE CO., New Britain.

BROOKLYN, N. Y.—Bids are asked by John V. Coggey, Comr. Correction, until 11 a. m., Aug. 4, for furnishing all the labor and materials required for repairs and alterations to City Prison, Boro. of Brooklyn.

NEW YORK, N. Y.—Bids are asked by the Department of Education until 11 a. m., Aug. 3, for new fireproof main stairs at Public Schools 11, 33, 39, 46, 93, 104, 108, 120, Boro. of Manhattan.

Bids are asked by the Corporation Counsel, Law Dept., Hall of Records, until noon, Aug. 5, for repairs and alterations to, and the material and labor required for alterations in rooms on sixth and seventh floors; also for extension of the electric lighting equipment; for carpentry and cabinet work, hardware, metallic and other furniture, painting, electric lighting fixtures, marble and bronze work, plastering, fireproofing and other work in the Hall of Records Building.

Bids are asked by Nicholas J. Hayes, Fire Comr., until 10.30 a. m., Aug. 4, for furnishing all the labor and materials required for the erection and completion of a new building for Engine Company No. 206, West New Brighton, Boro. of Richmond.

NEW YORK, N. Y.—We are officially advised that contract will be let Aug. 15 for an apartment house to be built at s. w. corner 122d St. and Claremont Ave. It will be six stories high, semi-fireproof, brick, stone and terra cotta, 100 × 100 ft. Electric elevator, dynamo, steam boiler, mail chute, hot water heater, etc., will be required. Estimated cost of building, $100,000; equipment, $50,000. Moore & Landsiedel, Archs., 148th St. and Third Ave. The Dacorn Realty Co., 95 Liberty St., is the owner.

NEW YORK, N. Y.—Bids were received as follows by the Board of Education on July 27 for the general construction, etc., of additions to and alterations in Public School No. 84, Boro. Brooklyn: Thos. Cockerill & Son, 147 Columbus Ave., New York, $244,220; John F. Reilly, $266,400; Jas. McArthur, 516 Beach St., Richmond Hill, $237,000; Harry Berry & Co., Evergreen (L. I.), N. Y., $238,429; Chas. H. Peckwith, 415 Hudson St., New York, $267,440; Geo. Hilderbrand, 3 Park Row, New York, $277,440; Clarke & Stowe, 221 Greenpoint Ave., Brooklyn, $252,200.

Bids were received at same time for installing heating and ventilating apparatus in new Public School No. 93, Boro. Brooklyn: Railser Heating Co., 1966 Broadway, New York, $29,787; John Hankin & Son, 550 West 25th St., New York, $32,667; Daniel J. Rice, 2 East 42d St., New York, $34,674; E. Rutzler Co., 127 White St., New York, $31,324; Frank Dobson Co., 319 East 53d St., New York, $30,784; Blake & Williams, 211 West 20th St., New York, $29,994; Wm. J. Olvaney, 177 Christopher St., New York, $32,589; Jas. Curran Mfg. Co., 512 East 36th St., New York, $30,500; Wm. C. Ormond, 909 President St., Brooklyn, $30,980.

NEW YORK, N. Y.—Plans have been filed for the improvement of the irregular plot at Nos. 25 to 29 Beekman St., extending through the block to Nos. 57 and 61 Ann St., with a 12-story and basement commercial building to be erected for the Nassau-Beekman Co. Robert Ralston Reed is Pres. The building will have a frontage of 53 ft. on Ann St. and 67.11 ft. on Beekman St., and will be 239 ft. deep, with an extension 63.8 × 56.9 ft., partly covering the alley. It will be of brick and granite, with trimmings of limestone and terra-cotta. The facade will be finished with pilasters of Ionic pattern at the first two stories, and at the two topmost stories supporting a cornice and balustrade. The building will be equipped with a full power plant for manufacturing. Estimated cost, $800,000.

ALBION, N. Y.—Bids are asked until 2 p. m., Aug. 11, for construction, heating, plumbing and electric work of industrial building, hospital enlargement and addition to boiler house at the Western House of Refuge for Women, Albion, N. Y. Mrs. Jane L. Armstrong, Pres. of the Board of Managers.

AUBURN, N. Y.—Frank H. Armstrong, Arch., Seward Block, is preparing plans for a 4-story and basement red brick orphan asylum, 66 × 112 ft., with wing, 44 × 45 ft., on North St., for the Auburn Orphan Asylum. It will be of slow-burning mill construction and will cost $75,000.

WILLIAMSVILLE, N. Y.—John Blocher, of Buffalo, will erect and donate to the Old Peoples' Home at this place, a 3-story home and dormitory building, 60 × 70 ft., to be constructed of boulder stone and brick with hardwood finish, steam heat, gas and electric fixtures, bath tubs, lavatories, etc. H. Osgood Holland, 417 Mutual Life Bldg., Buffalo, is Arch.

SYRACUSE, N. Y.—Plans are being prepared by Archimedes Russell and Melvin L. King, Archs., Snow Bldg., for remodeling the old county building into a building to be used by the Board of Education and Police Department. The work will cost $100,000.

HUDSON, N. Y.—Bids are asked until 1 p. m., Aug. 8, by Charles Strong, Pres. Board of Managers, New York State Training School for Girls, at Hudson, for the construction, heating, and plumbing of Cottages 8 and 9, and for trunk conduit and branches to cottages, road construction and grading. F. B. Ware is State Arch.

*POUGHKEEPSIE, N. Y.—Bids are asked until 3 p. m., Aug. 12, by the State Commission in Lunacy, at the Capitol, Albany, N. Y., for furnishing and installing four horizontal tubular boilers at Hudson River State Hospital, Poughkeepsie.

ALBANY, N. Y.—The R. T. Ford Co., of Rochester, holding State contract for the construction of the $3,500,000 Educational Building at Albany, has sublet to M. F. DOLLARD, of Albany, the contract for excavating foundation. There will be about 65,000 cu. yds. of excavation. The work will begin at once.

The ORVILLE MARBLE CO., of Clarendon Springs, has been awarded the sub-contract for furnishing all the marble needed for the Educational Building, Albany. It is estimated 150,000 cu. ft. of marble will be required. The R. T. FORD CO., of Rochester, N. Y., is general contractor.

ELMIRA, N. Y.—Bids are asked by W. J. Deans, Secy. Bd. Education, until noon, Aug. 3, for new steam heating boilers and for connecting same to the present heating system and the erection of a boiler room for No. 4 school building, Elmira. Two proposals will be received; one for the erection and completion of the boiler room and one for the boilers and connections.

ROME, N. Y.—Bids are asked until noon, Aug. 10, for construction, heating, plumbing and electric work of a building to replace old building "C," at the Rome State Custodial Asylum, Rome, N. Y. Hon. R. C. Briggs, Pres. of the Board of Managers.

ROCHESTER, N. Y.—Bids are asked by J. F. Warner, Arch., 1096 Granite Bldg., Rochester, until 10 a. m., Aug. 4, for the entire work for a mortuary chapel (including the mason work, carpenter work, painting, electric lighting, plumbing and heating), to be built at Mount Hope Cemetery.

HUNTINGTON (L. I.), N. Y.—Adden & Parker, Archs., 12 Bosworth St., Boston, Mass., advise us that bids will be received until 1.30 p. m., Aug. 3, for a 3-story High School, 138 × 84 ft., fireproof, brick, concrete; $80,000 has been appropriated by the Huntington Board of Education.

*FORT HANCOCK, N. J.—Bids are asked by Capt. M. N. Falls, Const. Q. M. (Sandy Hook, N. J.), until 2 p. m., Aug. 27, for painting exterior and interior of buildings, laying composition floors in two rooms and making minor repairs to the hospital and dead-house at Fort Hancock, N. J.

NEWARK, N. J.—The Prudential Insurance Co., of Newark, will erect a 12-story office building on the block bounded by Broad, Halsey, Academy and Bank Sts. Estimated cost, $2,500,000. Geo. B. Post, 341 Fifth Ave., New York, is the Arch. The contractor will be the HEDDEN CONSTRUCTION CO., 1 Madison Ave., New York. The actual work of construction will be begun May 1, 1909, when most of the leases on the present buildings expire. The new structures will be completed during the latter part of 1910.

ORANGE, N. J.—Bids are asked by the Board of Education until Aug. 3 for an addition to the Lincoln Ave. Public School. Estimated cost, $70,000.

CAMDEN, N. J.—J. E. & A. L. PENNOCK, Land Title Bldg., Philadelphia, Pa., have the contract for the new building for the Y. M. C. A. of Camden, N. J. The building will stand on Federal St., near Broadway, and will cost $150,000. The structure will be five stories in height, 119 × 125 ft., of brick and stone. It will contain a swimming pool in the basement, gymnasium, class rooms, library and auditorium. Howes & Morse are Archs., 19 West 38th St., New York.

MERCER, PA.—Owsley & Boucherle, Archs., Wick Bank Bldg., Youngstown, Ohio, advise us that bids will be received the latter part of August or first part of September, for the erection of a court-house to be erected here at a cost of $200,000. The building will be 92 × 180 ft., three stories in height, and constructed entirely of stone. It will contain a central steam heating plant and electric light plant.

PITTSBURG, PA.—The contract for the erection of the new Washington sub-district school on 40th St. has been awarded to GOLDEN & CRICK, 3512 Fifth Ave., Pittsburg, at about $60,000. This does not include the sub-contracts for plumbing, ventilating, heating and mechanical equipment for the manual training departments. The building will be two stories in height, 62 × 113 ft., of reinforced concrete, and will have private power plant and heating plant in the basement. Charles W. Bier, 219 Sixth St., Pittsburg, is Arch.

LATROBE, PA.—Philip S. Black, Arch., has awarded general contract to the CONCRETE CONSTRUCTION CO., Altoona, Pa., for a 2½-story and basement brick and stone school building for the Latrobe Board of Education, to cost about $50,000.

CLARION, PA.—Allison & Allison, Archs., Westinghouse Bldg., Pittsburg, are preparing plans for a 3-story girls' dormitory for the State Normal School, Clarion. The structure will cost $80,000.

PITTSBURG, PA.—Bids are asked by the City Controller until 10.30 a. m., Aug. 3, for the erection of an engine-house at Chartiers and Church Aves. Plans, specifications, blank proposals and bonds can be obtained at the office of Charles J. Rieger, Arch., 1302 People's Bank Bldg., Pittsburg.

HAZLETON, PA.—The Supervising Architect of the Treasury, Washington, has awarded contract for the construction of a post-office building at Hazelton, Pa., to ROBT. S. RATHBUN, Allentown, Pa., at $51,618.

WASHINGTON, D. C.—Bids were received as follows July 25, at the office of the Superintendent of the United States Capitol Buildings and Grounds, Washington, for electric fixtures for the new Senate Office Building: Lawrence Gas Fixture Mfg. Co., 129 N. 12th St., Philadelphia, $45,157; Sterling Bronze Co., 113 W. 25th St., New York $57,295; Enos Co., 16th St. and Seventh Ave., New York, $42,614; Wahle Philips Co., 551 W. 52d St., New York, $37,482; Cassidy & Son Mfg. Co., 133 W. 23d St., New York, $52,845; Lloyd Garrett Co., 2115 Wood St., Philadelphia, $54,936; Mitchell Vance Co., 836 Broadway, New York, $35,000; L. Plaut & Co., 432 E. 23d St., New York, $42,956; J. B. McCoy & Co., 114 W. 30th St., New York, $40,574; David J. Braun Mfg. Co., Washington and Union Sts., Chicago, $37,-646.

WHEELING, W. VA.—S. F. Heckert, Arch., 341 Sixth Ave., Pittsburg, has let general contract to JOHN L. GIESEY, Wheeling, for a 3-story brick addition to college for Mount De Chantal University, Wheeling. Cost, $75,000.

NEW ORLEANS, LA.—The new Cordill Building, which is to be erected by C. C. Cordill on the site of his former building on Canal St., will be five stories high, and will have a front of 28.6 ft., and a depth of 158 ft. on the first floor and on the other floors 144 ft. The facade will be of white, full-enameled terra cotta, with polychrome ornaments. Toledano, Wogan & Shepard, 121 Carondelet St., New Orleans, are Archs.

CHATTANOOGA, TENN.—J. T. Lupton, The Elizabeth, Chattanooga, has purchased a 40-acre site at Riverview, a suburb, and will erect a residence at an approximate cost of $100,000. Other improvements are to be made. W. T. Downing, News Bldg., Chattanooga, is Arch.

NASHVILLE, TENN.—Carpenter, Blair & Gould, Archs., 475 Fifth Ave., New York, are preparing plans for a 10-story hotel at Nashville, for the Hermitage Hotel Co. It will cost about $450,000.

RICHMOND, KY.—C. C. & E. A. Weber, Archs., First National Bank Bldg., Cincinnati, are preparing plans for a 2-story school building, 3-story girls' dormitory, 3-story university hall building and a 3-story addition to boys' dormitory, for the Eastern Kentucky State Normal School, Richmond. Cost, $140,000.

CLEVELAND, OHIO.—The Euclid Ave. School Association, Mrs. Sarah Lyman, Supt., will erect a school building to cost $100,000. F. S. Barnum, Supt. Bldgs., Bd. of Education, is Arch.

The Bailey Co., 146 Ontario St., will erect a 10-story steel and concrete building on Ontario St., costing $300,000. Victor W. Sincere is Supt. The structure will be on the site of the old 3-story brick adjoining the store's main building. It will have a frontage of 80 ft. and a depth of 125 ft. Lehman & Schmitt, Garfield Bldg., Cleveland, are Archs.

COLUMBUS, OHIO.—JOHN HECKERT has been awarded the contract for the erection of a 6-story addition to Grant Hospital at about $125,000. Mr. Heckert was the low bidder for the construction of the J. & G. Butler Building on East Chestnut St., between Third and Fourth Sts.

CHARDON, OHIO.—Bids are asked by Robt. S. Parks, Village Clerk, until noon, Aug. 4, for the erection of a building to contain public hall, fire department quarters and public offices.

INDIANAPOLIS, IND.—Plans are being prepared for a home to be erected by Murat Temple, Mystic Shrine, at the corner of New Jersey and Michigan Sts. The building will cost about $250,000, is to be of terra-cotta and pressed brick, with a stone foundation, and of Egyptian design. The plans are being prepared by D. A. Bohlen & Son, Archs., Majestic Bldg., Indianapolis.

PONTIAC, MICH.—Bids will be received by the State Military Board, at office of adjutant-general, State Capitol, Lansing, until 2.30 p. m., Aug. 19, for the erection of an armory at Pontiac. Fisher Bros., Archs., Pontiac.

IONIA, MICH.—Bids will be received by the State Military Board, at office of Adjutant-General, State Capitol, Lansing, until 2.30 p. m., Aug. 19, for the erection of an armory at Ionia. E. A. Bowd, Arch., Lansing.

MILWAUKEE, WIS.—Preliminary plans have been prepared by Ferry & Clas, Archs., 419 Broadway, Milwaukee, for the proposed home for the Calumet Club, which will be built on Ninth St., between Grand Ave. and Wells St., at a cost of $55,000. The structure probably will be built of stone and it is designed to be three stories high.

BURLINGTON, IOWA.—General contract has been let to McLAIN & DANNIES, Burlington, for a 5-story brick building to be erected at Fourth and Valley Sts., for S. R. & I. C. McConnell, at a cost of about $100,-000. H. I. Goddard, City, is Arch.

COLFAX, IOWA.—Geo. P. Stauduhar, Arch., 320 20th St., Rock Island, Ill., has plans ready for figures for a 4-story hotel, at Colfax, for Col. James Donohue, Davenport, Iowa. Estimated cost, $125,000.

EVELETH, MINN.—Plans are being prepared by Bray & Nystrom, Palladio Bldg., Duluth, for a 2-story school building for the Board of Education, W. J. Smith, Clk., Eveleth. Estimated cost, $75,000.

*GRAND RAPIDS, MINN.—Bids are asked until 2 p. m., Aug. 17, by Maj. Francis R. Shunk, Corps Engrs., U. S. A., St. Paul, for building keeper's dwelling and office building at Pokegama Dam, Mississippi River, near Grand Rapids, Minn.

ST. PAUL, MINN.—Rev. A. C. Stevens, 1020 Laurel Ave., will receive bids until Aug. 10, for the general construction of the superstructure of the First M. E. Church at Victoria St. and Portland Ave. It will have steam heating, electric lighting and modern plumbing; brick and stone exterior. Thori, Alban & Fisher, 508 Chamber of Commerce, City, Archs. Cost, about $70,000.

GREAT FALLS, MONT.—COOMBS & KING of Great Falls, have received the contract for furnishing the brick for the railroad buildings to be erected at Judith Gap.

BUTTE, MONT.—No bids were received July 27 by the Supervising Architect of the Treasury in answer to invitation for bids on extension and remodelling of the post-office building at Butte, Mont.

JOPLIN, MO.—The Joplin Union Depot Co. has been incorporated with a capital of $500,000. The company will build a union passenger station in this city. The capital stock is held by the Missouri and North Arkansas Railroad and the Atchison, Topeka & Santa Fe and their officials, W. B. Jensen and Robert Dunlap, of Chicago; Thomas R. Morrow, of Kansas City; Charles Gilbert and W. S. Dowley, of St. Louis, the Board of Directors for the company.

HOUSTON, TEX.—Frank A. Hervey, Jr., proprietor of the Bristol Hotel, will construct an addition to the structure. It will be of reinforced concrete, between six and eight stories high, 55 × 100 ft., making entire building 155 × 100 ft. All rooms will have stationary wash-stands, supplied with hot and cold water. Cost, about $150,000. Improvements will be made to present building, including enlargement and remodelling of lobby at cost of $20,000. The buildings will be connected on the ground floor; the upper stories will be separated by air shaft for ventilation.

COLORADO SPRINGS, COLO.—JOHN ESCH, of Colorado Springs, has secured the contract for residence which is to be erected by Benjamin C. Allen, of this city, at Broadmoor. Estimated cost, $170,000.

SEATTLE, WASH.—Contract has been let by the Board of School Directors for construction of the proposed Queen Ann High School to ANDERSON & POWER CONSTRUCTION CO., Seattle. James Stephen, New York Block, is Arch. Estimated cost, $200,000.

PORTLAND, ORE.—G. Rosenblatt has been granted a permit to erect a 5-story brick lodging house on Tenth St., between Alder and Morrison Sts., to cost $110,000.

SAN FRANCISCO, CAL.—The Native Sons of the Golden West are to rebuild their hall on Mason St. in this city. The Board of Directors of the Hall Association has decided to proceed with construction at once. A building committee of the Hall Association, comprised of Lewis Byington, James D. Phelan, Mutual Savings Bank Bldg., and Adolph Eberhart, is working over the tentative plans submitted by the architect. It has been decided to have a 6-story brick hall building, with eight or ten lodge rooms, an assembly hall, and, in the basement, a banquet hall. Estimated cost, $125,000.

SANTA ROSA, CAL.—Bids are asked by Supervising Architect, Treasury Dept., Washington, D. C., until 3 p. m., Aug. 27, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post-office at Santa Rosa, Cal.

SALT LAKE CITY, UTAH.—A 6-story building is to be erected at South Temple and Richards Sts., by the Mormon Church. The building will cost $125,000. Monson & Schaub, 63 North Main St., Logan, Utah, are Archs.

BOISE, IDAHO.—Bids are asked by the Constructing Quartermaster until 11 a. m., Aug. 15, for constructing, plumbing, heating and electric wiring of a brick hospital at Boise Barracks, Idaho.

VANCOUVER, B. C.—Parr & Fee, Archs., have awarded to BAYNES & HORIE, of this city, the contract for a 3-story brick and stone building to be erected at Granville and Smythe Sts.

WATER SUPPLY—IRRIGATION.

(denotes that this work is advertised in Engineering News.)*

PEPPERELL, MASS.—We are officially advised that bids were received as follows by the city for laying about 13½ miles of water-pipe from 6 to 12 ins. in diameter: A. McKenzie & Co., $21,434; T. Bruno, $21,-750; Chas. N. Taylor, $22,918; Frank H. Cowing Co., $23,033; Loring N. Farnum Co., $23,962; Franklin A. Snow Co., $24,324; Frank A. Foster, $25,310; Edward B. Roberts, $25,476; C. E. Trumbull Co., $25,906; Antony Cefalo & Co., $25,919; John E. Palmer, $25,960; Long & Little & Co., $26,-174; Coughlan & Shiels Co., $26,306; Michele Russo & Son, $26,785; Ablett & Bowes, $26,-972; Bryne Contracting Co., $27,586; J. H. Clements & Son, $28,014; Frank Williams & Co., $31,982; Osgood Construction Co., $32,-956.

*NEW YORK, N. Y.—Bids were received as follows by the Board of Water Supply on July 23 for the construction of a portion of the Catskill aqueduct, consisting of about 6½ miles of plain concrete conduit, known as cut-and-cover aqueduct, 17 ft. high × 17 ft. 6 ins. wide, and about 3,470 ft. of tunnel, 17 ft. high × 13 ft. 4 ins. wide, on the hydraulic gradient, and known as Peak Tunnel, situated west of the Hudson River, on the south side of Esopus Creek Valley, in the towns of Olive and Marbletown, Ulster County, New York: Millard Construction Co., Philadelphia, Pa., $3,008,710; David Peoples, 271 Broadway, New York, $3,568,-835; Elmore & Hamilton, Albany, N. Y., $2,464,960; John J. Hart Co., 26 Beaver St., N. Y. City, $2,657,937; Reinhardt & Dennis, Washington, D. C., $2,627,230; Gore Engineering & Contracting Co., 206 Broadway, $2,664,465; Bradley Contracting Co., 320 West 68th St., New York, $4,062,990; STEWART-KERBAUGH-SHANLEY CO., 527 Fifth Ave., $2,368,820 (awarded contract); Cranford Co., 52 Ninth St., Brooklyn, N. Y., $4,604,025. Bids in detail will be given next week.

*NEW YORK, N. Y.—Bids are asked by the Board of Water Supply until 11 a. m., Sept. 1, for the construction of a 3-mile stretch of plain concrete conduit known as cut-and-cover aqueduct, 17 ft. high × 17½ ft. wide inside, approximately between Ireland Corners and New Hurley in the towns of Gardiner, Plattkill and Shawangunk, Ulster County, New York. J. Waldo Smith is Ch. Engr. Bd.

NEW YORK, N. Y.—Bids are asked by John H. O'Brien, Comr. Water Supply, Gas and Electricity, until 2 p. m., Aug. 12, for furnishing, installing, maintaining and reserving for the use of the high pressure fire service all apparatus and equipment necessary for generating and transmitting 1,830 KW. of 3-phase, 6,000-volt, 25-cycle electric power, and furnishing and delivering this power under the terms of this contract, from Aug. 15, 1908, to Dec. 31, 1908, at each of the high pressure fire service pumping stations located in the Borough of Brooklyn, at Furman and Joralemon Sts. and at Willoughby and St. Edwards Sts., respectively; also for furnishing, installing, maintaining and reserving for the use of the high pressure fire service, all apparatus and equipment necessary for generating and transmitting 3,250 KW. of 3-phase, 6,000-volt, 25-cycle electric power, and furnishing and delivering this power, under the terms of this contract, from Aug. 15, 1908, to Dec. 31, 1908, at each of the high pressure fire service pumping stations, located in the Borough of Manhattan, at Oliver and South Sts. and at Gansevoort and West Sts., respectively.

*YONKERS, N. Y.—Bids are asked by the Board of Contract and Supply until 8 p. m., Aug. 17, for furnishing and delivering on the public docks at Yonkers, before Oct. 1, 1908, 1,000 lengths of 8-in. B. and S. c.-i. pipe, weighing 625 lbs. per length, and 100 lengths of 4-in. pipe, weighing 280 lbs. per length. James D. McIntyre is Secy. Bd.

COHOES, N. Y.—Bids are asked by the Board of Water Commissioners until 8 p. m., Aug. 3, for repairing the slope walls of reservoir No. 3. W. J. Quirk is Clk. Bd.

OWEGO, N. Y.—The Owego Water-Works Co. has awarded contract to the P. B. McGAGHEY CO., Little Falls, N. Y., for a 1,600,000-gal. reservoir, at about $10,000.

ALBANY, N. Y.—The Board of Contract and Supply, Albany, has awarded to the CAMDEN IRON WORKS, of Camden, N. J., the contract for furnishing 2,247 tons of iron pipe and 45 tons of special castings for the city's water supply system. The contract price is $21.80 per ton for the pipe and $50 per ton for the castings. Harry J. Deutchbein is Supt. of the Water Bureau.

OSWEGO, N. Y.—The Department of Water on July 22 awarded to the KINGSFORD FOUNDRY & MACHINE CO. the contract for three horizontal tubular boilers of 150 HP. each, which are to be used at the new power station in connection with the lake water system. The award was made for Scotch boilers at $7,775.

YONKERS, N. Y.—Bids are asked by the Board of Contract and Supply, Manor Hall, until 8 p. m., Aug. 3, for excavating and building a brick suction well, 18 ft. in diameter and 22 ft. deep, at the tube well station. James D. McIntyre is Secy. Bd.

*BRIARCLIFF MANOR, N. Y.—Bids are asked until 3 p. m., Aug. 1, by William H. Coleman, Village Clk., for laying about 5,950 lin. ft. of 6-in. c.-i. water main with appurtenances in Scarborough Road, from the Waldron Road to Broadway. Specifications, plans and proposal blanks may be seen at the office of the Village Clerk or from Lederle & Provost, Engrs., 39 West 38th St., New York upon deposit therefore to secure the return of the same.

LOCK HAVEN, PA.—The Water Committee has awarded to A. C. CANDOR & CO., agents for R. D. Wood & Co., the contract for furnishing iron water pipe at $23.20 per ton of 2,000 lbs. for the 24 and 12-in. pipe, and $23.40 for the 10-in. pipe, and fittings at $2.50 per 100 lbs., all f. o. b. Lock Haven; also for furnishing hemp at $6.20 per 100 lbs. f. o. b. Lock Haven. The contract for pig lead has been awarded to W. A. McCLELLAN & CO., of Arden, N. Y., at $4.60 per 100 lbs.

PHILADELPHIA, PA.—Bids are asked by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., Aug. 15, for furnishing and installing four boilers with stokers, superheaters and stack at the navy yard here. Specifications are on file at the office of Engineering News, New York.

BRUNSWICK, MD.—The city has awarded the contract to the SPECIALTY CONSTRUCTION CO., of Norfolk, Va., at $11,448 for the construction of water-works, including the laying of mains, erection of fire plugs and tank system consisting of an 80,000-gallon tank, 6,887 ft. of 8-in. pipe, 540 ft. of 6-in. pipe, 2,246 ft. of 4-in. pipe, 26 fire-plugs, artesian well, engines and pumps. The tank will be located on an elevation of 264 ft. and will give a pressure of 108 lbs. per in.

*BURLINGTON, N. C.—We are officially advised that the following contracts were awarded on July 21 for the construction of a water-works and sewerage plant here: PANOMA TERRA COTTA CO., sewer pipe, $9,590; ABEE & EDWARDS, Hickory, N. C., water and sewer general construction, $37,-120; RUSSELL & CO., Burlington, reservoir and tower foundations, $3,700; P. & F. GLAMORGAN CO., hydrants and valves, $2,151; R. D. COLE MFG. CO., tower and tank, $4,669; THOMAS B. WHITTED & Co., machinery and setting, $4,746; U. S. CAST-IRON PIPE & FOUNDRY CO., pipe, $17,-709.

*DE FUNIAK SPRINGS, FLA.—Bids are asked by the Mayor and Council until noon, Aug. 14, for the construction of water-works. The Solomon-Norcross Co., Atlanta, Ga., are Engrs.

PENSACOLA, FLA.—Bids are asked until Aug. 4 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing a 30,000-gallon water tank of cypress or steel at the navy yard, Pensacola.

HARRISONBURG, LA.—Bids are asked by the Police Jury of Catahoula Parish until Aug. 3 for drilling an artesian well.

TOLEDO, OHIO.—The Board of Public Service on July 17 awarded the contract for the construction of intake pipe at the water-works filtration plant to JAMES [illegible] at $20,825. The Board rejected all bids received for the intake piers and new bids will be asked.

LAKEWOOD (Cleveland post-office), OHIO.—Bids are asked until Aug. 3 by the Board of Trustees of Public Affairs for furnishing material and constructing mains in Westwood Ave. and Park Row. The William H. Sackett Engineering Co. are Engrs., The Arcade, Cleveland.

TERRE HAUTE, IND.—Bids are asked by the Board of Commissioners of Vigo County, Coure House, until 11 a. m., Aug. 3, for laying a water main from pressure tanks in the basement of county jail to the Court House. Lewis P. Seeberger is Chn. Bd.

BATAVIA, ILL.—THE U. S. WIND ENGINE & PUMP CO., of Batavia, has the contract, at $10,823 for extension to the city water mains.

EARLHAM, IOWA.—The DES MOINES BRIDGE & IRON CO., of Des Moines, Iowa, has been selected to prepare plans for water-works and an electric light plant. Estimated cost, about $17,000. W. S. Shepherd is City Clk.

HALLOCK, MINN.—The Warren Machine and Iron Works, Warren, Minn., have submitted the only bid for constructing 300 ft. of 15-in. vitrified clay pipe in a 3-ft. trench, loamy clay excavation, and no ground water to be handled, at 75 cts., including one manhole at $70 and one catch-basin. J. E. Carroll, Crookston, Minn., is Engr.

BRAINERD, MINN.—The citizens voted on July 14 to issue $120,000 of bonds for the construction of water-works. George Cadagan Morgan, Royal Insurance Bldg., Chicago, Ill., is Engr.

ELGIN, MINN.—The contract for furnishing a 70,000-gallon steel water tower and c.-i. water mains for this city has been let by Alexander Scott, City Recdr., to the NATIONAL CONSTRUCTION CO., of South Bend, Ind. Loweth & Wolf, St. Paul, Minn., are Consulting Engrs.

ROSEDALE, KAN.—This town contemplates constructing water-works at a cost of $25,000. E. Eicholtz is Mayor.

LEAVENWORTH, KAN.—Bids are asked until 10 a. m., Aug. 5, by R. V. Lafbow, Supt. of Prisons and Prisoners, Washington, D. C., for pipe work for connecting up complete the new Russel engine at U. S. penitentiary here.

WESTON, NEB.—Bids are asked by J. Pacal, Village Clk., until Aug. 7, for the construction of water-works. Estimated cost, about $10,000. J. Martz, of Seward, Neb., is Engr.

*LINCOLN, NEB.—Bids are asked until noon, Aug. 14, at the office of Thomas H. Pratt, City Clk., for the construction of a reservoir of 1,700,000 gallons capacity, to be located at the Mockett pumping station. Plans and specifications may be had by the remittance of $2.50 to William Grant, City Engr., Lincoln, or may be seen at the office of Engineering News, 220 Broadway, New York, or in the office of the City Engineer, Lincoln.

JAMESTOWN, N. DAK.—Bids are asked until July 30 by G. E. Lyman, City Audr., for laying water mains in water main district No. 1.

FARGO, N. DAK.—Bids are asked until Aug. 3 by N. C. Morgan, City Audr., for constructing a water main in portions of Third Ave., Eleventh and Twelfth Sts., district No. 2.

CHEYENNE, WYO.—Bids are asked until Aug. 3 by J. D. Wright, City Clk., for extending the water-works system, requiring about 1,067 tons of c.-i. pipe, valves, hydrants, etc. C. C. Carlisle is City Engr.

LOVELL, WYO.—Willard T. Lovell, of Lovell, is preparing plans for water-works, to cost about $15,000. John F. Meldrum is City Clk.

GREAT FALLS, MONT.—John D. Ryan, at the head of the syndicate that recently purchased the Great Falls Water Power & Townsite Co., has announced that they will expend $1,500,000 in developing the water power and in other improvements at this city.

KANSAS CITY, MO.—The City Council on July 15 voted to appropriate $15,000 to repair Turkey Creek and Quindaro water pumping stations.

*DALLAS, TEX.—Bids are asked until 3 p. m., Aug. 15, by J. B. Winslett, City Secy., for constructing a chimney for the new pumping station near Turtle Creek, the chimney to be 7 ft. minimum inside diameter, and 140 ft. above boiler room floor, and to be constructed of concrete, or other suitable material, each bidder submitting plans, details, sizes and method of construction, with all information necessary to a full understanding of the work; also each bidder to submit strain sheets with his bid. Bidders to furnish all material, tools and labor and to do the work at their own risk.

SEATTLE, WASH.—Bids are asked by the city until Aug. 1 for the construction of subdivision No. 1, Cedar River Water Supply System No. 2.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

NIAGARA FALLS, N. Y.—The Board of Public Works has awarded the contract to SIMON TIORITTI, 1018 15th St., for the following sewer work: Sewer in 27th St.; sewer in Cleveland Ave. and Eleventh St.; sewer in Buffalo Ave. and Driveway. W. D. Robbins is City Engr. overflow sewer in Buffalo Ave. and Drive-

NEWARK, N. Y.—The Village Board has awarded the contract to A. A. BENNETT, 184 Jones St., Rochester, N. Y., for the construction of a sewer in South Main St., from Miller to Union Sts.

RYE, N. Y.—G. Everett Hill, Consulting Engr., 1 Fifth Ave., New York, has completed plans and will soon receive bids for a sewage disposal works, pipe sewers and pumping station for the village. George L. Henderson is Village Clk.

HALCOTTVILLE, N. Y.—The Halcottville Water Co., Hobart, N. Y., has been incorporated with a capital of $5,000 to supply water to Halcottville. The incorporators are George A. Buckle, A. L. O'Connor, James R. Cowan, all of Hobart.

SYRACUSE, N. Y.—The READ-CODDINGTON CO., Niagara Falls, N. Y., has been awarded the contract for approximately five miles of retaining wall in connection with 972. The work will require large quantities of metal reinforcing c.-i. pipe, w.-i. pipe and stop-valves.

LONG ISLAND CITY (L. I.), N. Y.—Bids are asked by Lawrence Gresser, Pres. Boro. of Queens, until 11 a. m., Aug. 11, for constructing a sewer and appurtenances in Third Ave., from Broadway to Graham Ave., First Ward, and for constructing one catch basin on the southeast corner of Sanford St. and Hamilton St., First Ward.

SYRACUSE, N. Y.—The City Engineer is preparing plans for the construction of brick or concrete sewers in various streets, bids for which will be asked by the Board of Contract and Supply.

BUFFALO, N. Y.—C. M. Morse, City Engr., is preparing plans for an 18-in. tile sewer in Pfandler St., between Delevan Ave. and the north end of street. Bids will be asked soon by Francis G. Ward, Comr. Pub. Wks.

BRONXVILLE, N. Y.—Bids are asked by Frank Dinsmore, Village Clk., until 8 p. m., Aug. 4, for the construction of sewers here. George H. Rogers, Tuckahoe, N. Y., is Engr.

ROCHESTER, N. Y.—The Board of Contract and Supply has awarded the contract to RIPTON & MURPHY, 72 Penn St., for constructing sewers in Nicholson St., Mt. Hope Ave. and Anthony St.

ELIZABETH, N. J.—The Board of Aldermen have received bids as follows for the purification of the Elizabeth River and the prevention of further pollution by the construction of an intercepting sewer in the middle of the stream, with a pumping station at the upper end at Union St. and Westfield Ave., the sewer to be about 18,000 ft. long from its start to the terminal of Staten Island Sound: Matthew Wade, Elizabeth, $136,382; Gallo & Musso, Newark, N. J., $136,384; J. H. Gray & Co., New York, $177,005; W. J. McCloud & Co., Elizabeth, $194,901; A. E. Sandford & Co., New York, $201,887; Harrison Construction Co., Newark, $212,164. The bids were referred to the Special Committee on River Improvement.

*FOREST CITY, PA.—Bids are asked by the Secretary of Council until 6 p. m., Aug. 20, for the construction of sanitary sewers. F. J. Howell & Co. are Engrs.

SHELBY, N. C.—WALTON & WAGNER, Atlanta, Ga., have been awarded the contract for constructing a sewer and water system at Shelby.

FORT BARRANCAS, FLA.—Bids are asked until July 31 by Capt. D. W. Hand, Constructing Q. M., U. S. A., for the construction of a drain from the pumping station.

MIAMI, FLA.—Bids are asked at the City Hall until noon, Aug. 6, for the construction of a trunk or out-fall sewer and appurtenances. Address the City Clerk.

MOBILE, ALA.—We are officially advised that bids were received as follows on July 13 by the Board of Public Works for the construction of storm sewers here: JEFF BROS., Mobile, Ala., $28,639 (awarded contract); C. M. Burkhalter, Birmingham, Ala., $34,449; Bosler & Flynn, Chattanooga, Tenn., $38,093; Irwin Bros., New Orleans, La., $30,203; Lee & Everroad, Columbus, Ind., $33,146; Russell & Jennison, Toledo, Ohio, $32,029; John R. Turner, St. Louis, Mo., $25,533; Sullivan & Long, Bessemer, Ala., $33,055.

NEWTON, MISS.—The city has adopted the plans of Xavier A. Kramer, Magnolia, Miss., for the construction of a sewer system for the business section for which $4,500 of bonds have been issued.

*VICKSBURG, MISS.—Bids are asked until 8 p. m., Sept. 7, by the Mayor and Board of Aldermen for furnishing materials and constructing complete, a system of house sewers, approximating 30 miles of 8-in. to 27-in. pipe sewers, with 400 manholes and 100 flush tanks. Blank forms, specifications and other information may be obtained from Walter G. Kirkpatrick, C. E., Jackson, Miss. Plans and specifications are on file at the City Hall, Vicksburg, and at the office of the engineer.

*LOUISVILLE, KY.—Bids are asked until noon, Aug. 14, by the Commissioners of Sewerage for the construction of a sewer known as the Broadway sewer, Contract No. 10, of the comprehensive system of sewerage for the city.

Bids are asked until noon, Aug. 21, for the construction of Section "D" of the Southern Outfall sewer, Contract No. 11. Plans and specifications for both may be seen at the office of the Commissioners and at the office of the Consulting Engineer, Harrison P. Eddy, of Metcalf & Eddy, 14 Beacon St., Boston, Mass. J. B. F. Breed is Ch. Engr. Comrs.

MADISONVILLE, KY.—L. B. Fuller, Consulting Engr., Chicago, Ill., is making surveys for the construction of a sewer and water-works system here.

CLEVELAND, OHIO.—J. J. FARREL & CO., Ashtabula, Ohio, have been awarded the contract for about three miles of 24-in. combination storm and sanitary sewer, at about $30,000.

LIMA, OHIO.—The Board of Public Service has awarded the contract to BLODGETT & HARDIN of Lima, for the construction of an 18-in. vitrified pipe sewer in Reece Ave., from Second to Third Sts. L. L. Crumrine is Secy. Bd.

COLUMBUS, OHIO.—CHRISTIAN BURKHARDT, of Cleveland, Ohio, secured the contract on July 15, for the construction of the Markeson Ave. main sanitary sewer at $4 per lin. ft. Total cost, about $25,000.

LAKEWOOD, OHIO.—Bids are asked until Aug. 3 by B. M. Cook, Village Clk., for furnishing the material and constructing the Woodward Ave. sewer. The Wm. H. Evers Engineering Co. are Engrs., The Arcade, Cleveland, Ohio.

CINCINNATI, OHIO.—The contract for the construction of relief sewers in Central, Harrison and Colerain Aves. and for a right-of-way was awarded on July 16 by the Board of Public Service to the WILLIAM HEFFRON CONSTRUCTION CO., Neave Bldg., at $43,584.

*SPRINGFIELD, OHIO.—Bids are asked until noon, Aug. 7, by the Board of Public Service at the office of William H. Mahoney, Clk., for the construction of the Indian Run intercepting sewer.

NORTH MANCHESTER, IND.—KING BROS., of North Manchester, have been awarded the contract, at $5,841, for the construction of a district sanitary sewer. A. C. Ebbinghous is Town Clk.

FLINT, MICH.—Bids are asked by the city until 3 p. m., Aug. 3, for constructing a sewer.

POCAHONTAS, IOWA.—Contracts for tile and open drains have been awarded as follows: Drainage district No. 33, R. A. ELZY & CO., Marshalltown, Iowa, $11,850; drainage district No. 8, same, $32,760; drainage district No. 27, PARSONS & SMITH, Humboldt, Iowa, $15,995. J. A. Terry is County Audr., Pocahontas County.

NEKOOSA, WIS.—F. E. KAMINSKI, of Berlin, Wis., has been awarded the contract, at $5,767, for the construction of 8 to 20-in. sewers.

BURLINGTON, IOWA.—J. F. Winters, City Engr., is preparing preliminary plans for a brick and reinforced-concrete sewer. Estimated cost, $150,000. Robert Kroppach is City Clk.

WINNEBAGO, MINN.—The city has awarded the contract for a gravity sewer system to WILLIAM FRASER, of Rochester, Minn., at about $10,000. J. H. Sherin is City Clk. Loweth & Wolf, St. Paul, Minn., are Consulting Engrs.

ST. PAUL, MINN.—The City Council has awarded the contract for a storm water sewer in Grove St. to JOHN LIND, at $11,000. L. W. Rundlett is City Engr. Geo. T. Redington is City Clk.

LARNED, KAN.—Bids are asked until 8 p. m., Aug. 10, by W. P. Peters, City Clk., for constructing about 21,000 ft. of sewer.

STEPHENVILLE, TEX.—The city will construct a 12-ft. sewer estimated to cost $12,000.

DALHART, TEX.—John B. Hawley, Consulting Engr., Ft. Worth, Tex., is preparing plans and specifications for a system of sewers here. Bids will soon be asked. W. D. Wagner is Mayor.

PORTLAND, ORE.—The lowest bid opened on July 14 by the Board of Public Works for constructing Section 1 of the Morrills Corner sewer, was submitted by R. D. Shanahan & Co. at $9,410.

OAKLAND, CAL.—Bids are asked until Aug. 5 by the Board of Public Works for furnishing material and constructing an extension to the storm sewer in Grove and Jones Sts. to Lake Merritt. Walter B. Fawcett is Secy. Bd.

LOS ANGELES, CAL.—The Board of Public Works has awarded the contract for the construction of a sewer in Griffith Ave. and in other streets to L. PEROVICH, at $14,884 for the sewer complete. Horace B. Ferris is Secy. Bd.

GARBAGE DISPOSAL.

(denotes that this work is advertised in Engineering News.)*

*FORT ANDREWS (Boston post-office), MASS.—Bids are asked in triplicate until 10 a. m., Aug. 25, by Capt. Ira L. Fredendall, Constructing Q. M., U. S. A., 263 Summer St., Boston, for the construction of a crematory building and construction and erection of a garbage crematory at this post.

BUFFALO, N. Y.—JOHN MARTIN was awarded the contract on July 22 by the city for street cleaning at $115,000 per year or $575,000 for five years. Other bidders were: Thomas Brown Contracting Co., $650,000 for five years; Buffalo Sanitary Co., $150,000 for one year, $750,000 for five years; Sanitary Collection and Reduction Co., $665,000 for five years; Queen City Sprinkling Co., $130,000 for one year, $595,000 for five years; Department of Public Works, $153,426 for one year, $767,130 for five years. On the separate districts basis for five years, the bids were as follows: John Martin, $604,950; Queen City Sprinkling Co., $599,760; Thomas Brown Contracting Co., $738,795.75.

The bid submitted by the Department of Public Works includes the block system service, which is not included in any of the other bids reported, as it was not asked for under the specifications. The block system provides for flushing with hose from the hydrants and hand brooming.

This system will still be carried on by the city at a yearly expense of $35,568. Francis G. Ward is Comr. Pub. Wks.

NEW YORK, N. Y.—Bids were received as follows on July 28 by Foster Crowell, Comr. of St. Cleaning, for the final disposition of all ashes, street sweepings and rubbish collected in the borough of Brooklyn, the City of New York: Borough Construction Co., 44 Court st, Brooklyn, 34½ cts. per cu. yd.; American Railway Traffic Co., 85 Clinton St., Brooklyn, 44 cts.

*NEW YORK, N. Y.—Bids were opened as follows on July 23 by Foster Crowell, Comr. St. Cleaning, for (a) the final disposition of all ashes, street sweepings and rubbish that may be delivered on board of deck scows or other vessels at the water-front dumps of the Department of Street Cleaning, in the Boroughs of Manhattan and the Bronx, on the Harlem River and on the East River, excepting the dump at the foot of Clinton St., East River; (b) the final disposition of all ashes, street sweepings and rubbish that may be delivered on board of deck scows or other vessels at the water-front dumps of the Department of Street Cleaning, in the Borough of Manhattan, on the Hudson River, and Clinton St. dump on the East River. (A), (B), (C), (D) represent price per scow; (E) represents kind of scow; (1), (2), (3) and (4) represent subdivisions of (E): F. P. Eastman Contracting Co., (a)—(A) $89, (B) $95, (C) $102, (D) 124, (E1) $140, (E2) $160, (E3) $220, (E4) $270, sea work, add 30%; Daly & Irons, (a)—$68, $75, $89.80, $105.90, $92.90, $100.90, add 29%; (b)—$71.90, $78.90, $92.90, $108.90, $92.90, $100.90, add 29%; Bradley Contracting Co., 172 Broadway, (a)—$91, $90, $111, $131, no bid, add 35%; Water Front Improvement Co., (a)—$75, $82, $95, $105, $82.50, $90, $127.50, $150, add 5%; (b)—$75, $80, $95, $105, $82, $90, $127.50, $150, add 5%; Moran Towing Transportation Co., informal.

UNION, N. J.—Bids are asked until 8 p. m., Aug. 3, by the Board of Council for the removal of garbage from the streets, avenues and thoroughfares of the town. Emil Bautz, Jr., is Town Clk.

*YOUNGSTOWN, OHIO.—Bids are asked by the Board of Health until noon, Aug. 29, for the collection and removal of garbage. Dr. H. E. Welch is Health Officer.

OAKLAND, CAL.—The STUDEBAKER WAGON CO. was awarded the contract on July 10 by the Board of Public Works for 20 sprinkling carts at $6,520. Walter B. Fawcett is Clk. Bd.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

ROCKVILLE, CONN.—The Public Works Committee has voted to macadamize Prospect St. and East Main St., at a cost of about $4,000.

HARTFORD, CONN.—The contract for paving Ford St., from Asylum to Pearl Sts., with asphalt, has been awarded by the Board of Contract and Supply to the SOUTHERN NEW ENGLAND PAVING CO. at $2.25 per sq. yd.; also $6.90 per cu. yd. for all extra concrete work. This company was the only bidder for the work.

NEW YORK, N. Y.—The M. BAIRD CONTRACTING CO., 433 East 92d St., New York, has submitted the lowest bid at $13,934 for repaving with granite block pavement, on a concrete foundation, the roadway of East 149th St., from Morris to Mott Aves., Borough of the Bronx.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Aug. 5, by Bird S. Coler, Boro. Pres., for regulating, grading and curbing Sherman St., from Eleventh Ave. to line between 22d and 29th Wards, together with all work incidental thereto, and for constructing cement sidewalks, 5 ft. in width, on the east side of Fiske Place, between Carroll St. and Garfield Place, and on various other streets in the Borough of Brooklyn.

BROOKLYN, N. Y.—Bids were received as follows on July 22 by Bird S. Coler, Boro. Pres., for (a) regulating, relaying brick gutters and paving with asphalt pavement on a concrete foundation the roadway of East 14th St. (Rugby road), from Dorchester Road to Ditmas Ave., together with all work incidental thereto; (b) regulating and paving with asphalt pavement on a concrete foundation the roadway of Hemlock St., from Jamaica Ave. to Etna St., together with all work incidental thereto: Barber Asphalt Paving Co., 114 Liberty St., New York, (a) $5,586; (b) $7,182; Uvalde Asphalt Paving Co., 1 Broadway, New York, (a) $5,769, (b) $6,992; Cranford Co., 52 Ninth St., Brooklyn, (a) $5,299, (b) $7,880.

NEW YORK, N. Y.—Bids are asked until noon, Aug. 10, by Allen N. Spooner, Comr. of Docks, for furnishing all the labor and materials required for repairing asphalt pavement on North and East Rivers, together with all work incidental thereto.

NEW YORK, N. Y.—Bids were received on July 21, by the President of the Borough for regulating and repaving with asphalt pavement on a concrete foundation the roadway of 105th St., from Second Ave. to Third Ave.: Asphalt Construction Co., Madison Ave. and 137th St., $7,223; Uvalde Asphalt Paving Co., 1 Broadway, $8,925; Sicilian Asphalt Paving Co., 41 Park Row, $7,098; Barber Asphalt Paving Co., 114 Liberty St., $7,428.

Bids are asked by Louis F. Haffen, Pres. Boro. of the Bronx, until 11 a. m., Aug. 4, for furnishing and delivering broken trap rock stone and screenings and for various street improvements.

LONG ISLAND CITY (L. I.), N. Y.—Bids are asked by Lawrence Gresser, Pres. Boro. of Queens, until 11 a. m., Aug. 11, for regulating, grading and paving with asphalt block pavement on a concrete foundation the roadway of Onderdonk Ave., from Elm (Harte) St. to Stanhope St., Second Ward, together with all the work incidental thereto; and for laying sidewalks and paving with asphalt block pavement on a concrete foundation the roadway of Academy St., from Freeman Ave. to Wilbur Ave., First Ward, together with all the work incidental thereto.

UTICA, N. Y.—The contract for paving Water, Seneca and Genessee Sts. with asphalt has been awarded by the Board of Contract and Supply to the BARBER ASPHALT PAVING CO., of Utica, at $1.94 per sq. yd.

ALBANY, N. Y.—The Board of Contract and Supply has awarded to JOHN M. HOLLER, Albany, the contract for paving De Witt St., from Broadway to Montgomery St., at $8,792; and to MICHAEL F. DOLLARD, Albany, the contract for paving Washington Ave., from Lexington Ave. to a point about 193 ft. east, at $3,278. Walter Mellus is City Engr.

*SARANAC LAKE, N. Y.—Bids are asked until Aug. 11 by Seaver A. Miller, Village Clk., for furnishing the material for and constructing about 3,500 lin. ft. of concrete sidewalk. On 2,000 lin. ft. of the above sidewalk, the necessary grading, including about 200 cu. yds. of earth excavation may be included in the bid or nor at the option of the bidder. Plans and profiles may be examined and specifications, instructions to bidders, and forms of proposal may be obtained at the office of Donald F. McLeod, Village Engr.

*PORT CHESTER, N. Y.—Bids are asked by the Village Trustees until 8 p. m., Aug. 10, for brick, wood block or bitulithic pavement, with a concrete foundation on either or all of three streets, approximately 26,000 sq. yds. J. A. Kirby & Son are Engrs.

*NEWBURGH, N. Y.—Bids are asked until 5 p. m., Aug. 10, by D. J. Coutant, City Clk., for paving and repaving a portion of Water St. with vitrified brick.

HAWTHORNE, N. J.—J. SMITH SOWERBUTT, 23 Paterson St., Paterson, N. J., has been awarded the contract for macadamizing and grading portions of Second and South Sts. William E. Thompson is Borough Clk.

FREEHOLD, N. J.—The Board of Chosen Freeholders of Monmouth County has awarded the contract to the MONMOUTH CONTRACTING CO., Red Bank, N. J., at $24,998, for constructing 17,407 ft. of stone road. E. Everett Throckmorton is Engr.

WINSTON-SALEM, N. C.—The city has awarded the contract to J. H. WINGATE, Roanoke, Va., for paving a portion of Church, Depot and Fifth Sts. at 69 cts. per sq. yd. The work includes excavating for sub-grade, laying bed of sand, placing blocks and packing, the city purchasing blocks. J. N. Ambler is City Engr.

SPARTANBURG, S. C.—The city will lay about 10,000 sq. yds. of granite-block paving. Bids are asked until Aug. 10. Fred L. Bryant is City Engr.

MOBILE, ALA.—We are officially advised that bids were opened as follows on July 13 by the Board of Public Works for (a) wood block pavement, (b) vitrified brick pavement, (c) 11,744 lin. ft of cement curbing: JEFF BROS., Mobile, (a) $80,681, (b) $7,717, (c) $4,110 (awarded contracts); Venable & McCandless, Atlanta, Ga., (a) $9,474; Chickamauga Quarry & Construction Co. (a) $90,295; Bryan & Sanders, Atlanta, (a) $87,806; Russell & Jennison, Toledo, Ohio, (a) $88,263, (b) $9,417, (c) $5,285; J. B. Turner, St. Louis, Mo. (a) $78,345, (b) $7,659, (c) $3,406; Bigler Bros., Bessemer, Ala., (c) $4,052; Lee & Everroad, Columbus, Ind., $4,815.

NEW ORLEANS, LA.—The RUDOLPH S. BLOME CO., 79 Dearborn St., Chicago, Ill., has been awarded the contract to lay patented granitoid pavement on Tulane Ave. and University Ave. at about $105,000.

CLINTON, TENN.—Bids are asked by Anderson County until Aug. 8 for constructing about 13 miles of road. Levi Foster, Chn. Comn.

Anderson County has awarded the following contracts for road construction: JOHNSON CO., Concord, Tenn., for 8½ miles of road; PETERS, GIBSON & CO., Knoxville, Tenn., 12¼ miles; H. A. MANN CO., Knoxville, four miles; WALLACE & LONGMIRE, three miles from Andersonville to Unicoi County line. Levi Foster is Chn. Road Comn.

CHATTANOOGA, TENN.—The SOUTHERN PAVING & CONSTRUCTION CO., First National Bank Bldg., Chattanooga, has been awarded the contract at $8,472 for resurfacing with asphalt about 500 lin. ft. on Eighth St. and paving with asphalt other streets.

MEMPHIS, TENN.—Bids are asked by the city until Aug. 14 for about 45,000 cu. yds. of grading and 65,000 sq. yds. of sheet-asphalt pavement on a concrete foundation. J. H. Weatherford is City Engr.

MEMPHIS, TENN.—Bids will soon be asked by the city for the construction of about 65,000 sq. yds. of sheet asphalt pavement on a concrete foundation and 45,000 cu. yds. of grading on Madison Ave. and Tait Ave.

CLEVELAND, OHIO.—The lowest bid opened on July 7 by the Board of Public Service for paving Kinsman Road was submitted by R. P. Burnett, Society for Savings Bldg., Cleveland, at $21,416. Other bidders were: M. E. Kavanaugh, 736 Society for Savings Bldg., $21,442; the Cleveland Trinidad Paving Co., 420 Lakeside Ave., N. E., $22,264; Interpret Paving Co., $24,595; Standard Paving Co., 409 Electric Bldg., $21,638; Northern Ohio Paving Co., Arcade, $22,049.

*EUREKA, ILL.—Bids are asked until 10 a. m., Aug. 12, by the city, for constructing about 1,400 lin. ft. of cement curb and laying about 8,000 sq. yds. of brick paving (gravel foundation with cement filler) H. S. Reynolds is City Clk.

RACINE, WIS.—JOHN O. JONES has been awarded the contract at $37,128.12, for 27,703 sq. yds. of brick paving on Washington Ave.

RHINELANDER, WIS.—The McGRATH CONSTRUCTION CO., of Green Bay, Wis., have been awarded the contract for the construction of 18,890 sq. yds. of 4-in. macadam, on a 6-in. rock foundation, at $1 per sq. yd; 7,330 cu. yds. of sand excavation at 35 cts, and for setting 1,020 lin. ft. of concrete combined curb and gutter, at 65 cts. Total, $25,475. Other bidders were: The McCugo Construction Co., $28,066; S. B. Stanfield, $26,995; Forrester & Feyan, $27,500; Dunn & Mead, $28,500. George C. Jewell is Controller.

OMAHA, NEB.—The contract for paving a portion of East Creighton Ave. with brick has been awarded to HUGH MURPHY, of Omaha, at $10,200. Andrew Rosewater is City Engr.

BUTTE, MONT.—James Welch has submitted the lowest bid for paving with granite blocks on South Main St. at $4.50 per sq. yd. for paving and 75 cts. per lin. ft. for concrete curbing, or $1.50 for granite curbing.

BOZEMAN, MONT.—The contract for paving with concrete blocks Main St. has been awarded to the S. BIRCH & SON CONSTRUCTION CO., of Salt Lake City, Utah, at the following prices: Excavation, 50 cts. per cu. yd.; fill, $1.25 per cu. yd.; 25,000 sq. yds. of concrete work, $1.95.

OZARK, MO.—Bids are asked by the city until Aug. 4, for improving Sycamore, Church, Cedar and Elm Sts. Z. Acuff is City Clk.

STEPHENVILLE, TEX.—The city has voted $5,500 of bonds for street improvements. N. C. Baldwin is Mayor.

MUSKOGEE, OKLA.—HESMER & DAVIS have been awarded the contract by the city for the construction of 75,000 sq. ft. of sidewalks here at 9¾ cts. per sq. ft.

OLYMPIA, WASH.—Bids are asked by the city until Aug. 3 for laying 7,500 yds of paving.

NORTH YAKIMA, WASH.—W. W. PETTIJOHN and R. S. BUSH have been awarded the contract by the City Council for grading Walnut St., from Eleventh Ave to Eighth St., at 67 cts. per lin. ft., or $4,221.

NORTH TORONTO, ONT.—The contract for the construction of concrete sidewalks has been awarded to the SCHOALES CONCRETE PAVING CO. at 44 cts. per lin. ft.

WINNIPEG, MAN.—The Board of Control has recommended that the bid of the Engineer of Construction be accepted for putting down a full width granolithic sidewalk on the east side of Main St., between Rupert St. and Logan Ave. The contract price is $3,721.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

AUBURN, ME.—The Lunn & Sweet Shoe Co. will erect a 4-story brick shoe factory, 150 × 50 ft., with a central and projecting tower in the center, for staircases, cloak rooms and toilets.

PEABODY, MASS.—The Marine Hardware Co., has plans prepared for a 2-story brick factory building, 50 × 100 ft., and a 2-story brick storehouse, 20 × 45 ft. The factory will be used for making marine hardware, and is an addition to the present plant. James J. Donovan is Mgr., Foster St.

SOUTH BOSTON, MASS.—H. L. Gilman & Co., Engrs. and Archs., 26 Linden Place, Brookline, Mass., advise us that they desire catalogs and information on the following items, and will be ready to call for bids on the same in about 30 days: Coal-handling apparatus for unloading from barges, and handling in power-house; 2,000 HP. of steam boilers, for heating; pipe and fittings, for steam, gas, water and compressed air, heating requirements at present about 200,000 sq. ft. radiation; pumps, including fire, boiler feed, and elevator pumps, electrically and steam driven, air compressor with capacity for 1,500 ft. free air per minute; 2,000 HP. gas engines with suction producers, direct connected to A. C. generators. This equipment is desired in connection with an industrial plant to be erected in South Boston on the water front. It will contain 3,000,000 sq. ft. of floor space, to be rented for manufacturing purposes. There will be about 20 buildings, eight stories high, fireproof, of reinforced concrete; wharf will have an area of over 1,000,000 sq. ft., as noted fully on July 16. There will be a car ferry or lighterage system. The entire cost will be over $10,000,000, the construction to extend over five or more years, but the first section will be completed and ready for occupancy early in the summer of 1909. Financial arrangements have been made and active work will begin early in the fall.

PROVIDENCE, R. I.—Plans are being prepared for the erection of several buildings recently destroyed by fire, for the American & British Mfg. Co., the machine shop to be 104 × 105 ft., and the power house 38 × 124 ft.

ALBANY, N. Y.—The New York Central & Hudson River R. R. Co. has awarded to L. B. MILLIKEN, of Indianapolis, Ind., the contract for constructing the erecting shop at the West Albany yards, at a cost approximating $250,000. It is stated also that the same contractor will be given the contract for constructing the proposed machine and blacksmith shops. George W. Kitredge is Ch. Engr.

BATAVIA, N. Y.—The Johnston Harvester Co. has awarded the contract to CHARLES A. ALEXANDER for a blacksmith shop, 80½ × 76 ft., concrete construction, monitor roof, and for building for the knife department, 43 × 200 ft., one story in height.

ROCHESTER, N. Y.—Bids are asked until 10 a. m., Aug. 10, by the Commissioners of Public Buildings at the office of the Purchasing Agent, Court House, for the installation of a refrigerating plant complete, operated by electric power at the Monroe County morgue. Crandall & Strobel, 400 Elwanger and Barry Bldg., are Archs.

COATESVILLE, PA.—The Megargee Paper Mills have completed and placed in operation a new mill near here, for the purpose of manufacturing water leaf paper for parchmentizing.

PITTSBURG, PA.—The H. C. Frick Coke Co. has started work on the three new coke plants to be built in the Connellsville coke district at a cost of $3,000,000. At the Filbert plant, in the Klondike field, work has been started on 700 coke ovens. A mine will be located at either end, and the whole system will be operated by electricity. Work has also begun on 1,000 ovens at Dearthtown, but the company has not yet succeeded in securing its rights of way for railroad tracks. This plant is expected to be ready to operate by Jan. 1. The new plant at South Brownsville will be completed by Sept. 15. The company has fired all but 80 of its 400 ovens at the Ronco mine, and is installing electrical haulage, for the purpose of increasing the capacity of the mine, so that the mills of the company in the Pittsburg district can still be supplied with coal from it in addition to the coal that goes into the ovens for coke.

MONESSEN, PA.—An addition to the plant of the Pittsburg Steel Co. here is to be erected and the new plant will be used for the manufacture of steel rods needed in the making of wire. It will occupy a space of 800 × 400 ft. Estimated cost, $1,000,000.

BALTIMORE, MD.—The Standard Overall Co., 413 West Pratt St., will erect a 5-story brick factory at Pratt and Penn Sts. The proprietors of the concern are Solomon Rosenbloom and Louis B. Suskin. R. B. Mason will construct the building, which will cover a lot 35 × 135 ft.

BUCHANAN, VA.—The Virginia Can Co. has had plans prepared for a factory building, 60 × 40 ft., fireproof, with brick walls, concrete floors, roof, doors, windows and ventilator screens to be of steel and iron. Estimated cost, about $20,000.

FARMVILLE, VA.—W. C. Newman of Atlee, Va., will probably establish an ice plant here.

FAIRMONT, W. VA.—The Knox Sox Co. has been organized with a capital stock of $5,000. J. P. Thompson is Pres.; R. Knox, is Treas. and Mgr. The company will establish a knitting factory for hosiery, and has purchased six machines for operation by steam power and has planned to erect a building and install larger equipment for a permanent plant.

CHARLESTON, W. VA.—Logan Linville, Coyle and Richardson Bldg., has organized the Linville Mfg. Co. to manufacture miners' lock number indicator invented by himself, and contemplates establishing a factory.

EAST DURHAM, N. C.—The Durham Cotton Mfg. Co. of East Durham is expending about $50,000 for improvements and installations of new machinery. It has installed finishing machinery and will install generators and motors in place of present boilers and engines to drive carding, spinning, finishing and dyeing machinery. This plant has 22,544 spindles and 820 looms.

GREENSBORO, N. C.—The Washington Steam Bakery has been incorporated with $50,000 capital stock by George F. Suppes, George W. Brandt and J. E. Brandt, Jr. The concern is a consolidation of George W. and J. E. Brandt's and George F. Suppes' bakeries.

AIKEN, S. C.—The Southern Cotton Oil Co., Augusta, Ga., contemplates the establishment of two fertilizer plants, one at Aiken, and one at Waynesboro, Ga.

COLUMBIA, S. C.—The Bombay-reed Mfg. Co., E. K. Ward, Gen. Mgr., will probably enlarge its plant.

MOBILE, ALA.—George C. W. Wertenberg, Beaumont, Tex., proposes the establishment of a fertilizer and soap factory and asks the privilege of collecting for a number of years all garbage, refuse matter and dead animals. Estimated cost, $100,000.

FORT PAYNE, ALA.—The Davis Hosiery Mills of Chattanooga, Tenn., have about decided to add 50 knitting machines to the equipment of the plant here. Contracts have been awarded for the new equipment and it is expected to arrive during the next several weeks. Other improvements tending to increase the output and improve the quality of the hosiery are also contemplated.

BIRMINGHAM, ALA.—The Tennessee Coal, Iron & R. R. Co. will establish a plant for treating with preservatives the timber used in it's mines. E. H. Ford of the wood-preservation department, Forestry Service, will be in charge here.

NEW ORLEANS, LA.—The International Car Co. has been incorporated with a capital stock of $350,000 to build a plant for constructing and repairing locomotives, cars, coaches and other industrial and railway equipment. Charles A. Ralston is Pres.; A. T. Lebaron, St. Charles Hotel, New Orleans, is Vice-Pres.

MEMPHIS, TENN.—The Memphis Button Works Co. incorporated with a capital stock of $100,000, will erect a 3-story frame structure and equip for the manufacture of buttons from mussel shells from Arkansas River. W. S. Watson is Mgr.

LEXINGTON, KY.—The Hukle Gas Engine & Mfg. Co. was organized on July 17 with a capital stock of $50,000, to manufacture gas engines. L. A. Ruckno, Louisville, Ky., is Pres.

HORSE CAVE, KY.—T. N. England & Co., Horse Cave, will establish a 5-ton ice plant here within the next 60 days.

LOCKLAND, OHIO.—The Reliance Textile & Dye Works, Covington, Ky., have purchased a site here and plans to build a large plant for dyeing and finishing textile fabrics. No definite arrangements have been made as to size and character of the buildings or the equipment of machinery.

CHICAGO HEIGHTS, ILL.—The Chicago Heights Land Association has closed a contract with the Hauser Shade Cloth Co. for the location of its works at the Heights. The company has awarded a contract to GEORGE H. FULLER for the erection of a factory building, 80 × 220 ft., one story high, boiler and engine house attached, and also an office building, at $32,000.

CHICAGO, ILL.—C. Kramer, J. W. Trefny and F. M. Murphy have incorporated the Richmur Hosiery Co., of this city with a capital stock of $25,000, to manufacture and deal in hosiery and general merchandise.

MAYVILLE, WIS.—The Northwestern Iron Co. has increased its capital stock from $500,000 to $1,000,000 and intends to make improvements for the plant here.

DEPERE, WIS.—The Straubel Machine Co. contemplates building a modern plant or machine shop to be 60 × 100 ft., one story high. Estimated cost, $25,000.

DULUTH, MINN.—Plans are being prepared for a main building to be built for the Ouellette & Baxter factory on 17th Ave. West, and Garfield St.

GREAT FALLS, MONT.—Contracts have been let by the Great Falls Iron Works for the erection of their new machine shops as follows: Steel frame work, etc.: WORDEN & ALLEN, Milwaukee, Wis.; carpenter work, C. O. JARL, Great Falls; for the erection of the building MULLEN & CO., of Pittsburg, Pa. Noted June 25.

FORT SMITH, ARK.—H. Pickle and A. M. Reaf have established a canvas glove factory and contemplate manufacturing kid and leather gloves.

ARDMORE, OKLA.—The Ardmore Fire Escape Co. has been incorporated with a capital stock of $5,000, by James D. Flynn, W. A. Harding and George C. Anderson.

Ardmore Milling Co., J. C. Whaley, Pres., incorporated with $50,000 capital stock, has purchased flour mills, grain elevators, etc., from the Whaley Mill & Elevator Co. and will improve the plant.

BERLIN, ONT.—The Hagen Shirt & Collar Co. will erect a 4-story factory, 65 ft. × 100 ft., on Wilmot St.

LACHINE, QUE.—H. C. Stone, 48 St. Francois Xavier St., Montreal, has been authorized to prepare plans for the locomotive plant to be built here by the Imperial Locomotive & Machine Works. L. Edye, Montreal, is Comr.

DUCK LAKE, SASK.—Plans have been completed for the erection of a flour mill by the Farmers' Milling Co. Cost $20,000. A. Baynton is Secy.

SAMPLE CARD
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MISCELLANEOUS CONTRACTS.

U. S. RECLAMATION SERVICE.—All news relative to canal projects, etc., will be found under Water Supply—Irrigation.

ESTHERVILLE, IOWA.—Bids are asked by Roy J. Ridley, County Audr., until 11 p. m., Aug. 4, for construction of County Drain No. 36.

DITCH.—Redwood Falls, Minn.—Bids were asked until July 18 by L. P. Larson, County Audr., for constructing the tile work for ditch No. 6. Contract was not let.

DREDGING.—Pekin, Ill.—Bids are asked until Aug. 5 by the Spring Lake Drainage Commissioners for the digging of open drains and ditches in the Spring Lake District.

DREDGING.—Cleveland, Ohio.—Bids are asked until 2 p. m., July 30, for dredging Toledo Harbor, Ohio, by Lieut.-Col. John Millis, Corps Engrs., U. S. A., Cleveland.

*DREDGE.—Petersburg, Va.—Bids are asked until noon, Aug. 31, by Carter R. Bishop, Pres. Lower Appomattox Board, for dredge "Cockade." R. D. Budd is City Engr.

DRAIN.—New Orleans, La.—Bids are asked until 11 a. m., July 31, for construction of drain and pumping station at Fort Barrancas, Fla. Capt. D. W. Hand, Constr. Q. M.

*CEMENT.—Detroit, Mich.—Bids are asked by Lieut.-Col. C. McD. Townsend, Corps Engrs., U. S. A., Detroit, until 3 p. m., Aug. 24, for furnishing 10,000 lbs. of Portland cement.

DITCH.—Sioux City, Iowa.—Bids are asked until 7 p. m., Aug. 3, by Lewis Strand, County Audr., Sanborn County, S. Dak., for construction of Long Lake Drainage Ditch No. 3.

DRAINAGE.—Clarion, Iowa.—Bids are asked until 2.30 p. m., Aug. 3, by E. M. Callender, County Audr., for construction of Drain No. 25 in Lincoln and Blain townships.

DITCH.—Sioux City, Iowa.—Bids are asked until 2 p. m., Aug. 3, by E. E. Hosmer, County Audr., for construction of Wolf Creek ditch. Martin Holmvig, Engr.-in-Charge, Sioux City.

*RIPRAP SEAWALL.—Boston, Mass.—Bids are asked by Lieut.-Col. Edw. Burr, Corps Engrs., U. S. A., until noon, Aug. 26, for building riprap seawall, Fort Heath, Winthrop, Mass.

*EARTH EXCAVATION.—Detroit, Mich.—Bids are asked by Lieut.-Col. C. McD. Townsend, Corps Engrs., U. S. A., until 3 p. m., Aug. 24, for earth excavation for lock pit at Sault Ste Marie, Mich.

*ABUTMENT.—Wheeling, W. Va.—Bids are asked until 11 a. m., Aug. 10, by Capt. F. W. Altstaetter, Corps Engrs., U. S. A., Wheeling, for constructing the abutment for Dam No. 19, Ohio River.

*COAL-HANDLING MACHINERY.—Philadelphia, Pa.—Bids are asked by Geo. R. Stearns, Dir. Dept. Public Works, until noon, Aug. 18, for Contract No. 94: coal-handling machinery for Lardner's Point.

EMBANKMENT.—Greenville, Miss.—Bids will be received until Aug. 3 by [illegible] sippi Levee Commission, Robt. [illegible] Asst. Ch. Engr., for constructing [illegible] 000 cu. yds. of embankment in [illegible] Levee District.

*REVETMENT, ETC.—Milwaukee, Wis.—Bids are asked until 2 p. m., Aug. 26, by Maj. W. V. Judson, Corps Engrs., U. S. A., Milwaukee, for building plank revetment, removing old pier, and [illegible] at Manistique Harbor.

DREDGING.—Boston, Mass.—Bids are asked until 2 p. m., July 31, by Board of Harbor and Land Commissioners for dredging about 23,000 cu. yds., [illegible] in West Falmouth Harbor, Mass. Hodgdon, Ch. Engr., State House, Boston.

CONDUIT.—Sioux City, Iowa.—[illegible] plans have been made for the [illegible] diverting conduit, construction of [illegible] requires a special election, which has not yet been called. Until this is settled nothing definite will be done. G. Y. Smith, City Engr.

*DREDGING.—Trenton, N. J.—Bids are asked by Harry Schneider, Commissioner of Waterways, Trenton, until noon, Aug. 18, for dredging a section of the proposed inland waterway from Cape May to Cape Henlopen Head N. J., near the former place. Henry J. Sherman, Engr.

DREDGING.—Brooklyn, N. Y.—Bids are asked by Allen N. Spooner, Commissioner of Docks, New York, until noon, Aug. 5, for Contract No. 1148 for furnishing all the labor and materials required for dredging about 4,200,000 cu. yds. between 28th and 39th Sts., South Brooklyn.

COAL BUNKERS.—Yonkers, N. Y.—Bids were received as follows by James D. McIntyre, Secy. Bd. Contract and Supply, on July 20 for rebuilding and extending the coal bunkers at the new service station, Tuckahoe Road: D. V. Murphy, Yonkers, $7,300; Lynch & Larken, Yonkers, $6,400; Geo. T. Kelly, Yonkers, $8,990; the McHarg-Barton Co., New York, $8,870.

*DREDGING.—Mobile, Ala.—Bids were received as follows on July 20 by Maj. H. Jervey, Corp Engrs., U. S. A., for dredging the mouth of the Pascagoula River, Miss. (all place measurement—amount available, 865,000): Southern-Bowers Dredging Co., Galveston, Tex., 11½ cts. a cu. yd.; John Andersen, Gulfport, Miss., 11¾ cts.; North American Dredging Co., Galveston, 12 cts.

DITCH.—Council Bluffs, Iowa. Bids were received by the joint drainage boards of Harrison and Pottawattamie Counties on July 20 for construction of the Boyer Cut-off No. 3. (Bids for this work were asked until June 19, but none of the contractors enclosed the certified check required and all were rejected. Noted on June 4.) Contract was awarded to C. A. HOAG, Missouri Valley, Iowa, at 14¾ cts. a cu. yd. Total, $1,180.

*CEMENT.—Columbus, Ohio.—Bids are asked by the Board of Public Works until noon, Aug. 11, for the delivery of Portland hydraulic cement f. o. b. at the following railway stations, freight prepaid: 1,815 bbls. at Minster; 4,400 bbls. at Celina; 425 bbls. at Tippecanoe; 800 bbls. at West Carrollton; 725 bbls. at Miamisburg; 700 bbls. at Hamilton; 900 bbls. at Hebron. Particulars may be obtained from Charles E. Perkins, Ch. Engr. Pub. Wks., Columbus, Ohio.

SCOWS.—New York, N. Y.—Bids were received on July 21 by Foster Crowell, Comr. of St. Cleaning, for the construction of 15 scows. Contract was let to IRA S. BUSHEY, foot 20th St., Brooklyn, at $4,950 each. Other bidders were: Jacob Rice & Co., Kingston, N. Y., $5,649 each; George B. Spearin, 90 West St., $7,348; Jenks-Asserson Construction Co., 61 Pearl St., $7,897; Burlee Dry Dock Co., Port Richmond, N. Y., $6,200; J. W. Sullivan, foot East Ninth St., $6,583; James Tregarthen & Sons, foot Seventh St., $5,550.

*CREEK IMPROVEMENT.—Syracuse, N. Y.—Bids were received as follows on July 23, by Henry J. Hamlin, Secy. Syracuse Intercepting Sewer Board, 112 Court House, Syracuse, for improving Onondaga Creek. The work covers approximately 2½ miles in length. Its principal items are 76,000 cu. yds. excavation and 14,800 cu. yds. concrete blocks and mass concrete: READ, CODDINGTON ENGINEERING CO., Niagara Falls, N. Y., $219,972 (awarded contract); W. J. Burns Co., $253,408. Itemized bids will be given next week under Contract Prices.

CLEANING AND PAINTING STEEL.—New York, N. Y.—Bids are asked by John Cloughen, Acting-Pres. Boro. Manhattan, until 2 p. m., Aug. 4, for cleaning and painting complete, all the iron and steel work of the Riverside Drive viaduct, Boro. of Manhattan, together with all work incidental thereto. Engineer's estimate of amount of work to be done: 7,000 tons of iron and steel. Also, at the same time, for cleaning and painting, complete, all the iron and steel work of the 155th St. viaduct, Boro. of Manhattan, including tin roofs of all stairways, together with all work incidental thereto. Engineer's estimate, 3,800 tons of iron and steel.

*BARGE CANAL.—Albany, N. Y.—F. C. Stevens, Supt. of Public Works, has awarded to the EMPIRE ENGINEERING CORPORATION, 60 Wall St., New York, Contracts Nos. 60 and 64, Barge Canal, in accordance with bids submitted on July 21. For Contract No. 60, its bid was $1,349,051, the engineer's estimate being $1,267,500; and for Contract No. 64, its bid was $1,290,492, the engineer's estimate being $1,207,900. The award of these two contracts to the Empire Engineering Corporation makes a total of five contracts for barge canal construction work held by it, having a total value of about $4,300,000 William Barclay Parsons is Ch. Engr. The itemized prices of the bids received on July 21 will be given next week under Contract Prices.

CONTRACT PRICES.

*FILTERS.—Reading, Pa.—Bids were received, in detail, as follows by the Board of Water Commissioners on July 10 for constructing slow sand filters for Bernhart Water Supply, Reading. Lincoln S. Ramsey is Secy. Bd. Bidders were: (A) David Peoples, Philadelphia, Pa.; (B) JOHN F. ALBRECHT and ADAM H. LEADER, Reading, Pa. (awarded contract); (C) Millard Construction Co., Philadelphia; (D) H. E. Ahrens Co., Reading; (E) Blackstaff Engineering Co., Philadelphia; (F) Bennis Construction Co., Philadelphia; (G) Robert C. Storrie, Philadelphia; (H) Wm. Nolan, Jr., Sinking Springs, Pa.; (I) S. W. Chiles, South Bethlehem, Pa.; (J) L. H. Focht & Son, Reading; (K) New York-Continental-Jewel Filtration Co., New York, N. Y.; (L) James E. Bunting and Roberts, Bull & Co., (a corporation), Flushing, N. Y.; (M) Fehr & O'Rourke, Reading:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
42,[illegible] cu. yds. excavation	$0.48	$0.00	$0.00	$0.38	$0.65	$0.49	$0.45	$0.79	$0.645	$0.60	$0.77	$0.47	$0.53
[illegible] cu. yds. concrete masonry	6.09	4.48	7.00	7.40	7.00	7.33	6.00	5.61	4.95	6.00	3.30	5.10	6.25
[illegible] cu. yds. brick masonry	9.00	7.20	10.00	7.50	8.00	10.00	10.00	10.00	8.00	4.12	8.00	7.00	5.69
[illegible] cu. yds. broken stone or gravel and coarse sand for underdrains	2.50	1.70	2.44	3.40	2.50	2.95	2.00	1.35	1.40	2.75	2.00	2.75	1.50
[illegible] cu. yds. placing filter sand	1.00	.45	.40	.59	.50	1.50	.75	.80	.55	.65	.60	.35	.50
[illegible] cu. yds. cinder fill	1.50	1.10	.75	.50	1.00	1.00	.75	.95	1.00	2.00	.60	1.50	.75
[illegible] sq. yds. vitrified brick gutters	.65	.29	.60	.33	.40	.50	.25	.42	.80	.35	.30	.70	.39
[illegible] sq. yds. roadway	1.00	1.15	.80	.80	1.40	1.00	.75	1.40	.90	1.00	.70	1.00	1.25
[illegible] sq. yds. walks	.75	2.00	.40	.40	.70	.50	.50	1.34	.40	.50	.40	1.00	1.08
[illegible] sq. yds. sodding	.25	.22	.25	.22	.30	.10	.25	.19½	.18	.26	.35	.25	.25
[illegible] ft. 18" vitrified pipe	.90	.82	.85	.85	1.15	.80	1.00	.94	.80	1.00	1.10	1.00	.92
[illegible] ft. 15" vitrified pipe	.75	.44	.57	.55	.80	.70	.75	.84	.50	.90	.80	.70	.62
[illegible] ft. 12" vitrified pipe	.60	.30	.37	.35	.70	.60	.50	.48	.35	.57	.65	.50	.46
[illegible] ft. 10" vitrified pipe	.60	.25	.28	.35	.70	.50	.50	.48	.35	.50	.45	.50	.41
[illegible] ft. 8" vitrified pipe	.40	.23	.19	.21	.50	.50	.50	.28	.25	.40	.30	.40	.40
[illegible] ft. 6" vitrified pipe	.30	.10	.15	.16	.35	.40	.50	.19	.25	.30	.20	.20	.24
[illegible] ft. 4" vitrified pipe	.20	.20	.12	.14	.30	.25	.40	.19	.25	.20	.15	.20	.21
[illegible] ft. 6" underdrains	.15	.12	.16	.20	.30	.45	.40	.21	.35	.30	.20	.25	.20
[illegible] vitrified drains for vaulting (lump sum)	150.00	210.00	.10	47.20	210.00	100.00	400.00	90.00	100.00	85.00	150.00	200.00	241.67
[illegible] step (lump sum)	200.00	175.00	200.00	215.00	175.00	100.00	400.00	175.00	250.00	146.00	250.00	400.00	192.50
[illegible] house faced with granite (lump sum)	12,955	12,427	12,700	12,595	16,000	13,281	7,500	11,373	14,800	11,386	16,000	12,800	11,034
Filter house faced with Indiana limestone (lump sum)	10,970	9,191	9,400	9,265	10,275	10,905	7,000	8,500	12,900	8,000	14,000	9,400	8,552
Total amount of bid with filter house faced with granite	$83,494	$75,317*	$87,599	$81,864	$97,598	$94,605	$74,318	$90,184	$81,069	$85,038	$92,758	$74,910	$80,821
Total amount of bid with filter house faced with Indiana limestone	$81,510	$72,080	$84,290	$78,623	$91,873	$92,229	$73,818	$87,311	$79,169	$81,652	$90,758	$71,510	$78,339

*Awarded contract.

*RESERVOIR, ETC.—Concord, Mass.—Bids were received by Metcalf & Eddy, Engrs., for the Water and Sewer Commissioners, 14 Beacon St., Boston, Mass., on July 8, for laying c.-i. pipe and appurtenances and constructing a reservoir at Concord. Bids in detail and bidders were as follows: (1) Frank Williams & Co., 19 Willard St., Boston; (2) BRUNO & PETITTI, 18 Tremont St., Boston, (awarded contract); (3) Chas. N. Taylor, Wellesley, Mass.; (4) Auguste Saucier, South Framingham, Mass.; (5) B. Perrini & Co., Ashland, Mass.; (6) D. Cuozzo, 53 Park Row, New York; (7) The Loring N. Farnum Co., 53 State St., Boston; (8) M. McDonough, Swampscott, Mass.; (9) Falvey & Kelley, 15 Intervale Park, Dorchester, Mass.; (10) Long & Little Co., Leominster, Mass.; (11) Coughlin & Shiels, 43 Tremont St., Boston; (12) Rowe Contracting Co., Melrose, Mass.; (13) G. Louis Burnham, Andover, Mass.; (14) Coleman Bros., 15 Court Sq., Boston; (15) Chas. G. Craib & Co., Winthrop, Mass.; (16) Donovan & Phillips, 15 Beacon St., Boston.; (17) M. Russo & Son, 240 North St., Boston.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1,000 cu. yds. earth excavation	$0.60	$0.30	$0.30	$0.27	$0.30	$0.35	$0.28	$0.50	$0.60	$0.42	$0.40	$0.50	$0.40	$0.50	$0.40	$0.50	$0.52
50 " " " "	1.00	1.00	.60	.70	.90	.60	.60	1.00	.70	.75	.50	.75	1.00	2.00	1.00	1.00	.60
9,000 " " " "	.55	.50	.50	.40	.54	.75	.60	.50	.55	.65	.75	.65	.80	.50	.75	1.00	2.30
500 " " Rock "	3.00	3.00	3.50	3.50	4.00	3.00	3.00	3.50	4.00	3.50	3.00	3.00	3.00	4.25	4.00	3.50	4.60
200 " " " "	2.50	1.50	1.00	1.75	2.50	2.50	2.50	2.00	3.00	2.00	1.75	1.50	2.00	2.00	2.00	3.00	2.30
Addit. Haul, 200 ft., per cu. yd.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2,000 lin. ft. Laying 16" Pipe	.30	.48	.50	.61	.60	.70	.57	.70	.55	.65	.60	.75	.60	.80	.75	1.00	.65
20,000 " " " 12" pipe	.25	.34	.42	.41	.35	.35	.47	.50	.50	.55	.40	.55	.48	.60	.50	.80	.65
70 " " " 10" pipe	.20	.30	.35	.36	.35	.35	.45	.40	.40	.50	.40	.55	.40	.60	.50	.75	.57
200 " " " 8" pipe	.15	.24	.30	.29	.35	.30	.20	.30	.30	.35	.35	.30	.30	.50	.40	.50	.37
200 " " " 4" pipe	.10	.20	.25	.25	.30	.25	.20	.25	.25	.25	.35	.30	.25	.50	.30	.50	.37
121 " " pipe laying and boxing	2.00	2.00	2.00	2.00	3.00	2.50	1.00	3.00	1.00	1.25	1.25	2.50	2.00	5.00	4.00	2.00	1.25
Take up 100' old pipe (lump sum)	...	25.00	25.00	9.00	30.00	75.00	25.00	10.00	50.00	45.00	40.00	10.00	50.00	50.00	15.00	25.00	25.00
Setting hydrants (5)	10.00	2.00	2.00	6.00	2.50	5.00	5.00	5.00	5.00	2.00	6.50	5.00	5.00	5.00	10.00	5.00	5.00
30 cu. yds. brick masonry	14.00	12.00	15.00	14.50	15.00	12.00	11.00	15.00	15.00	18.00	17.00	14.00	17.00	15.00	20.00	18.00	16.50
50 " " concrete masonry	20.00	10.00	6.50	10.00	9.50	7.00	8.00	7.00	12.00	7.75	9.00	7.00	8.00	10.00	10.00	11.00	13.80
150 " " concrete masonry	6.00	10.00	6.50	8.00	6.75	7.00	6.50	8.00	8.00	7.25	7.50	10.00	10.00	8.00	8.00	9.00	13.80
350 " " concrete masonry	7.50	10.00	6.50	9.00	8.00	7.50	8.00	8.00	8.00	7.00	7.50	10.00	12.00	9.00	10.00	10.00	13.80
900 sq. yds. slope paving	.90	1.00	1.20	.85	1.50	1.00	1.75	1.50	1.10	1.50	2.50	1.50	.90	1.25	2.00	3.50	1.15
300 cu. yds. screened gravel	2.00	1.50	2.00	1.13	1.50	1.25	1.10	2.00	1.50	1.25	1.50	1.25	2.00	.75	2.00	2.00	2.30
8,000 sq. ft. Clinton wire cloth	.03½	.06	.03	.04½	.03	.05	.02½	.04	.03	.03½	.04	.03	.05	.05	.05	.05	.02¼
9,000 lbs. steel bars	.03	.05	.04	.05	.05	.05	.02½	.04	.04	.03¾	.04	.03	.04½	.05	.03	.04	.03
3,500 sq. yds. seeding	.10	.05	.04	.03	.05	.10	.05	.03	.03	.05	.01	.02	.05	.04	.02	.05	.03
200 cu. yds. dry rubble wall	6.00	2.00	3.00	3.00	3.50	3.00	4.00	4.50	5.00	2.75	2.50	2.00	4.00	5.00	4.00	3.00	4.60
Total	$22,011	$23,511	$23,636	$23,743	$24,567	$25,527	$26,360	$27,571	$27,814	$28,651	$28,842	$29,658	$30,605	$30,787	$31,564	$41,669	$49,984

U. S. POSSESSIONS AND CUBA.

*BRIDGE.—Cuba.—Bids are asked until 2 p. m., Aug. 31, at office of the Governor of Province of Havana, for construction of a viaduct bridge over the Almendares River. Data regarding plans and specifications can be obtained at office of Wm. Barclay Parsons, 60 Wall St., New York.

*METAL WORK.—Hawaii.—Bids are asked by the Light-House Board, Washington, D. C., until 11 a. m., Aug. 26, for furnishing the metal work for the tower for Makapuu Point Light-Station, Oahu, T.

TRADE PUBLICATIONS.

STEAM SPECIALTIES.—The Ohio Brass Co., Mansfield, O. Catalog No. F. Paper; 6 × 8½ ins.; pp. 12; illustrated.

In this pamphlet are described high grade bronze gage cocks, water gages and gate valves, and heavy pattern bronze fittings.

OIL SEPARATORS.—The Marion Incline Filter & Heater Co., Marion, O. Paper; 6 × 9 ins.; pp. 2; illustrated.

The Packard oil separator is of simple construction and is guaranteed to be effective in the elimination of oil from exhaust steam. It is made for pressures up to 50 lbs. per sq. in. This folder contains an explanation of the action and advantages of the Packard separators and a table of their dimensions for 2 to 24-in. pipes.

STEEL DUMP CARS.—The Arthur Koppel Co., 125 Morris Building, N. Y. Paper; 5¾ × 8½ ins.; pp. 18; and folder; 3½ × 8½ ins.; both illustrated.

The folder describes the Koppel V-shaped dump car, while the booklet contains excellent reproductions of photographs showing these cars in use on various jobs of construction work.

DRAWING MATERIALS AND SURVEYING INSTRUMENTS.—Kolesch & Co., 138 Fulton St., New York. Paper; 6 × 9 ins.; pp. 248; illustrated.

In this catalog is described a complete line of drawing and tracing papers, sun print papers and equipments, drawing instruments and materials, and surveying instruments and accessories. Numerous interesting novelties are shown.

ROOTS' BLOWERS.—P. H. & F. M. Roots Co., Connersville, Ind. Paper; 7½ × 10 ins.; pp. 41; illustrated.

In this booklet are described the various methods of driving rotary blowers, including a method of direct connection with a flexible coupling. Tables are given for facilitating the computation of requisite sizes of air mains and blowers.

BLOWERS FOR RAILROADS.—American Blower Co., Detroit, Mich. Paper; 7 × 9 ins.; pp. 50; illustrated.

Representative installations of "A B C" blowers in the transportation field are illustrated and described in this pamphlet, showing the great variety of applications of which this type of apparatus is capable.

PROGRESS REPORTER. — Niles-Bement-Pond Co., 111 Broadway, New York. Paper; 9 × 12 ins.; pp. 20; illustrated.

The July issue contains descriptions of various new machine tools, including a combined, slotting, boring, drilling and milling machine.

For other Proposal Advertisements see pages 43, 44, 45, 46, 50, of Advertisements and Construction News page 44.

PAVING AND CURBING.

Eureka, Ill.

Bids are asked for furnishing material and building about 1,400 lineal feet of cement curb and laying about 8,000 sq. yds. of brick paving (gravel foundation with cement filler) in the City of Eureka. Bids will be opened Wednesday, August 12, at 10.00 a. m. Plans and specifications on file with the City Clerk, H. I. REYNOLDS.

BRIDGE.

Salisbury, Md.

Sealed proposals, addressed to the County Commissioners of Wicomico County, for the construction of a steel plate girder draw bridge over the Wicomico River at the crossing of Main Street, Salisbury, Maryland, will be received until 12 o'clock noon, of the eighteenth day of August, 1908, according to the specifications on file with the Clerk, by the County Commissioners at their office in Salisbury, Md. Each bid must be accompanied by a certified check for $200.00, which will become the property of the County, should the successful bidder fail to execute a contract awarded to him. The County Commissioners reserve the right to reject any and all bids.

By order of the Board.

H. M. CLARK,
Roads Engineer.

STREET PAVING.

Newburgh, N. Y.

Sealed proposals will be received at office of City Clerk, in City Hall, Newburgh, N. Y., until 5 o'clock p. m., of Monday, August 10, 1908, for furnishing all materials for paving and repaving that portion of Water Street between the south side of South Street and the south side of Broad Street with vitrified brick pavement.

There is about 7,610 square yards to be paved, curbstones to be set, etc.

Cash or certified check for $500.00 must accompany each bid.

Plans and specifications are on file and may be seen at the office of City Engineer, City Hall.

The City Council reserves the right to reject any or all bids.

Dated, Newburgh, N. Y., July 28, 1908.

D. J. COUTANT,
City Clerk.

WM. J. BLAKE, Jr.,
City Engineer.

BRIDGE.

Havana, Cuba.

On the 31st day of August, 1908, between 2.00 and 2.30 o'clock p. m., sealed bids will be received in the office of the Governor of the Province of Havana, for the construction of a viaduct bridge over the Almendares River.

At 2.30 p. m., the bids presented will be opened and read publicly, awarding the construction of the work to the most advantageous bidder.

The Government reserves the right to reject any or all proposals.

Data as to plans, specifications and conditions of contract can be obtained at the office of Messrs. Wm. Barclay Parsons, 60 Wall Street, New York City; or at the office of Public Works of the Province of Havana, Aguiar 57, Havana, Cuba.

Dated, Havana Cuba, 27th July, 1908.

HIGHWAY BRIDGE.

Rye, N. Y., July 28, 1908.

Sealed proposals will be received by the Village Clerk, Rye, N. Y., until 8 P. M., August 12th, 1908, and then publicly opened, for furnishing all labor on Bradford Ave., Rye, N. Y.

The work will be divided and separate bids received as follows:

I. Foundations, including piles, concrete and rubble masonry.

II. Steel superstructure, erected complete with concrete floor. Span of bridge 21 feet, width 25 feet.

Plans and specifications can be obtained from the Village Engineer, Rye, N. Y.

The right is reserved to reject any and all bids.

DANIEL H. BEARY,
Chairman Road and Bridge Committee.

CRAIG E. NIGHTINGALE,
Village Engineer.

BRIDGE.

THE SANITARY DISTRICT OF CHICAGO.
TO CONTRACTORS.

Sealed proposals addressed to the Board of Trustees of the Sanitary District of Chicago, and endorsed "Proposals for the Equipment of the Eight-Track Bridge at Campbell Avenue," will be received by the Clerk of the said Sanitary District at the offices of the said District on the 15th floor of the American Trust Building, Chicago, Illinois, until 12 m., Standard Time, on Wednesday, September 2, 1908, and will be publicly opened by the Board of Trustees at a meeting to be held on that day, or the first meeting thereafter.

The work for which said tenders are invited, consists of supplying all mate-

rials and labor, excepting for Electrical Work and Interlocking, necessary for the equipment of the Eight-Track Bridge for the Pittsburg, Cincinnati, Chicago and St. Louis Railway Company, the Chicago Terminal Transfer Railroad Company and the Chicago Junction Railway Company, crossing the Main Drainage Channel of The Sanitary District of Chicago at Campbell Avenue, Chicago, Ill., so that said bridge may be operated as a movable bridge to allow navigation in said channel, said work to be completed on or before April 1, 1910.

Said bridge consists of four parallel double track through arch spans of two leaves each, which are so constructed that by the addition of said equipment, consisting of track girders, segmental girders, counterweight, machinery and other necessary work, the bridge may be operated as a Rolling Lift Bridge of the Scherzer Type.

The said work is to be performed in accordance with plans, specifications and contract furnished by The Sanitary District of Chicago, which plans, specifications and contract may be obtained upon application at the said office of the said District.

Each bid must be accompanied by a certified check or cash to the amount of five thousand ($5,000.00) dollars. All certified checks must be drawn on some responsible bank doing business in the City of Chicago, and shall be made payable to the Clerk of The Sanitary District of Chicago. Said amount of five thousand ($5,000.00) dollars, deposited with bids, shall be held by the Sanitary District until all of the respective bids for said structure have been canvassed and the contract awarded and signed. The return of said check or cash to the bidder to whom said work shall have been awarded will be conditioned upon his appearing within ten (10) days after receiving notice of such award, with bondsmen, and executing a contract with the Sanitary District for the work so awarded, and giving a bond, satisfactory to the Board of Trustees, for the fulfillment of said contract for the equipment of said bridge in the amount of One Hundred Thousand ($100,000.00) Dollars.

A deposit of Fifteen ($15.00) Dollars will be required for each set of plans and specifications taken out, said sum of Fifteen ($15.00) Dollars, deposited, to be refunded by said Sanitary District upon the return of said plans and specifications to said District.

All bids must be upon blank forms furnished by the Sanitary District.

Bidders are required to state in their bids their individual names and places of residence in full.

The said Board of Trustees reserves the right to reject any and all bids.

THE SANITARY DISTRICT OF CHICAGO.
By ROBERT R. McCORMICK,
President of its Board of Trustees.
Attest:
I. J. BRYAN, Clerk.
Chicago, July 30, 1908.

BRIDGE.

THE SANITARY DISTRICT OF CHICAGO.
TO CONTRACTORS.

Sealed proposals addressed to the Board of Trustees of The Sanitary District of Chicago, and indorsed "Proposals for the Equipment of the Eight-Track Bridge, Single Leaf Design," will be received by the Clerk of the said Sanitary District at the offices of the said District, on the 15th floor of the American Trust Building, Chicago, Illinois, until 12 m., Standard Time, on Wednesday, September 2, 1908, and will be publicly opened by the Board of Trustees at a meeting to be held on that day, or the first meeting thereafter.

The work for which said tenders are invited consists of the removal of the existing channel spans of the Eight-Track Bridge for the Pittsburg, Cincinnati, Chicago and St. Louis Railway Company, the Chicago Terminal Transfer Railroad Company and the Chicago Junction Railway Company, crossing the Main Drainage Channel of The Sanitary District of Chicago at Campbell Avenue, Chicago, Ill., and of the construction of new Single Leaf Channel Spans and supplying the necessary Machinery and Electrical Equipment therefor, so that said bridge may be operated as a movable bridge to allow navigation in said channel. Said work is to be completed on or before April 1, 1910.

Said Channel Spans will consist of four parallel double track, through, single leaf Scherzer Rolling Lift Bridges located alternately on piers as shown on the plans.

The said work is to be performed in accordance with plans, specifications and contract furnished by The Sanitary District of Chicago, which plans, specifications and contract may be obtained upon application at the said office of the said District.

Each bid must be accompanied by a certified check or cash to the amount of Fifteen Thousand ($15,000.00) Dollars. All certified checks must be drawn on some responsible bank doing business in the City of Chicago, and shall be made payable to the Clerk of The Sanitary District of Chicago. Said amount of Fifteen Thousand ($15,000.00) Dollars, deposited with bids, shall be held by The Sanitary District until all of the respective bids for said structure have been canvassed and the contract awarded and signed. The return of said check or cash to the bidder to whom said work shall have been awarded will be conditioned upon his appearing within ten (10) days after receiving notice of such award, with bondsmen, and executing a contract with The Sanitary District for the work so awarded, and giving a bond, satisfactory to the Board of Trustees, for the fulfillment of said contract for the equipment of said bridge in the amount of One Hundred Thousand ($100,000.00) Dollars.

A deposit of Fifteen ($15.00) Dollars will be required for each set of plans and specifications taken out, said sum of Fifteen ($15,00) Dollars, deposited, to be refunded by said Sanitary District upon the return of said plans and specifications to said District. Provided same are returned within thirty (30) days after the date on which said bids are opened.

All bids must be upon blank forms furnished by the Sanitary District.

Bidders are required to state in their bids their individual names and places of residence in full.

The said Board of Trustees reserves the right to reject any and all bids.

THE SANITARY DISTRICT OF CHICAGO.
By ROBERT R. McCORMICK,
President of its Board of Trustees.
Attest:
I. J. BRYAN, Clerk.
Chicago, July 30, 1908.

BRIDGES.

Aurora, Illinois.

Bids will be received until 2 o'clock p. m. of Saturday, Aug. 8, 1908, and at that time will be publicly opened and read, for constructing two reinforced concrete arch bridges across Fox River on Fox Street, in the City of Aurora, Illinois.

Each bridge consists of three spans; each span of about 50 feet length; roadway 40 feet wide; sidewalks ten feet wide.

Plans and specifications may be secured from the City Clerk upon the receipt of a deposit of twenty-five dollars. All bids must be accompanied by a certified check for ten per cent. of total amount of the bid.

Bidders must be skilled and regularly engaged in the class of work bid for.

E. J. RAYMOND,
City Clerk.

WATER-WORKS.

De Funiak Springs, Fla.

Sealed proposals for the construction of a system of water-works for the Town of De Funiak Springs, Florida, will be received by the Mayor and Council of said Town until twelve (12) o'clock noon, August 14th, 1908.

Bidders must use the proposal sheets furnished by the town and should address their proposals to "Wm. W. Flournoy, Mayor, and mark them "Proposals for Furnishing Material and Constructing Water-Works."

The plant will consist of an elevated tank with a maximum head of one hundred and thirty-five (135) feet, 75,000 gals. capacity; one (1) duplex steam pump, 500 gals. per minute capacity; one (1) 60-HP. boiler; approximately 3 miles of mains, 4 to 10 inches in diameter; deep well pump, thirty-one (31) fire hydrants, valves and valve boxes, etc. Proposals will be received, first for furnishing the material and constructing the water-works system, the town to furnish the material, for the whole work, or any of the sub-divisions as shown by the specifications.

Each proposal must be accompanied by a certified check for an amount equal to 3% of the bid as a guarantee that the contract will be entered into if awarded. A bond of 25% of the contract price will be required. Payments will be made in cash on monthly estimates.

Plans and specifications are on file at the office of the Mayor of De Funiak Springs, Fla., and also at the offices of the Solomon-Norcross Co., Engineers, 1622-23 Candler Bldg., Atlanta, Ga. Bidders may obtain same by enclosing check for $10.00, payable to Engineers, to be held until return of plans. The Council reserves the right to reject any or all bids.

WM. W. FLOURNOY,
Mayor.
Engineers.
SOLOMON-NORCROSS CO.,
Atlanta, Ga.

CAST-IRON PIPE.

Office of the
Board of Contract and Supply,
Yonkers, N. Y., July 27, 1908.

Sealed proposals will be received at the office of the Board of Contract and Supply, Manor Hall, Yonkers, N. Y., until eight o'clock p. m., of Monday, August 17, 1908, for furnishing and delivering on the Public Dock at Yonkers, before October 1, 1908, one thousand lengths of eight-inch B and S cast-iron pipe, weighing 625 pounds per length, and one hundred lengths of four-inch pipe, weighing 280 pounds per length.

Proposals to be enclosed in a sealed envelope addressed to the Board of Contract and Supply, endorsed "Proposals for Cast-Iron Pipe," with the name and address of the bidder; each proposal to be accompanied in a separate envelope by a certified check to the order of Gideon H. Peck, Treasurer, for five per centum of the total amount of the bid, to be forfeited upon failure to enter into a contract if awarded, within ten days after notice thereof.

JAMES D. McINTYRE,
Secretary.

The dimensions here given are for the cards mentioned in letter on advertising page 25.

The stock used should be no heavier than 22 x 28—140.

3"

5"

⅜ in. diam.

Situations Wanted

Civil Engineers.

YOUNG UNIVERSITY GRADUATE, with three years' technical training and more than a year's experience with railway maintenance-of-way, desires position. Best of references and samples of work furnished. Municipal, railway or contracting positions acceptable. Address "S. A. 5," Engineering News, New York. 5-1t

Draftsmen.

DRAFTSMAN (29), wishes position as general assistant with contractor or engineer. HILLMUTH, 7 Grant Ave., Brooklyn. 5-1t

Superintendents, Misc., etc.

OPEN FOR ENGAGEMENT as engineer of construction or superintendent; 20 years' experience on heavy construction work, pneumatic foundations, water powers, tunnels, bridges, roads, etc. HOWARD J. COLE, 29 Broadway, New York City. 5-1t

Situations Open

WANTED—A Bright, active, young engineer with some experience on construction work to act as assistant superintendent of construction on large work. To right party an excellent opportunity to learn the business and become associated with important construction operations. Address "R. A. 5," Engineering News, New York. 5-1t

WANTED—By Portland cement company, cement salesman, familiar with New York State trade. Must be experienced. Excellent opportunity for the right man. Address "W. A. 5," Engineering News, New York. 5-1t

WANTED—Structural draftsman by a railroad under construction in middle South; college graduate, with some experience in design of steel bridges, railroad shops and buildings. Must be neat vertical letterer. Salary $85 to $100. State age, experience, education, references, date can report, and enclose sample of work. ENGINEER of B. & B., C. C. & C. Ry., Johnson City, Tenn. 5-1t